THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL.

VOL. 28. Thursday, November 1, 1923. No. 376.

PUBLISHED WEEKLY.

Subscription Terms: 15s. per annum.
Foreign and Colonial, 17s. 6d. per annum.
All Subscriptions are payable in advance.

All communications to be addressed to the Editor, or to the Publisher, as the case may be, of

THE FOUNDRY TRADE JOURNAL,
BESSEMER HOUSE, 5, DUKE STREET, ADELPHI,
LONDON, W.C.2.

Contents.

	PAGE
Bribery and Corruption in the Foundry	367
"Moulders" of the Industry.—No. 20	368
Institute of British Foundrymen	368
The Use of Cast Alloys for the Working Parts of Machinery	369
Desulphurisation of Foundry Coke	373
Tests on Piping and Shrinkage in Cast Iron	376
Correspondence	377, 381
Contracts Open	377
An Apprenticeship Course in Foundry Practice.—LXIII.	378
Casting Bronze Tablets	380
The British Cast Iron Research Association	381
Trade Talk	382
Company News	382
Personal	382
Obituary	382
Iron and Steel Markets	384

Forthcoming Events.

NOVEMBER 1.

Institute of British Foundrymen (London Branch):—Ordinary meeting in London. "Details of Continental Moulding Machine Practice," Paper by A. S. Beech.

NOVEMBER 3.

Institute of British Foundrymen (West Riding of Yorkshire Branch):—Ordinary meeting at Bradford. "Non-Ferrous Metals and Alloys in Engineering," Paper by E. L. Rhead, M.Sc.

Institute of British Foundrymen (Lancashire Branch):—Ordinary meeting at Manchester. "Test Bars—Making and Testing Them," Paper by J. S. Glen Primrose, A.R.T.C.

Institute of British Foundrymen (Scottish Branch):—Ordinary meeting at Glasgow. "The Briquetting and the Use of Cast Iron Borings," Paper by J. A. Gardner.

NOVEMBER 8.

Institute of Metals (London Local Section):—Ordinary meeting in London. "Some Impressions of American Non-Ferrous Metallurgy," Paper by W. Rosenhain, D.Sc., F.R.S.

NOVEMBER 9.

Institute of Metals (Sheffield Local Section):—Ordinary meeting at Sheffield. "Substitutes for Platinum," Paper by E. A. Smith, A.R.S.M.

The Manchester Association of Engineers:—Ordinary meeting in Manchester. "Crushing of Materials," Paper by J. R. Birch.

Association of Engineers (Barrow and District):—Ordinary meeting at Barrow. "Centrifugal Pumps and their Adaptability," Paper by W. F. Clement.

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN AND THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION.

Institute of British Foundrymen.

PRESIDENT, 1923-24, Oliver Stubbs, M.I.Mech.E., Openshaw, Manchester.

LIST OF SECRETARIES—

General Secretary: W. G. Hollinworth, 38, Victoria Street, London, S.W.1.
Lancashire: T. Makemson, 21, Beresford Road, Gorse Hill, Stretford, Manchester.
Birmingham: H. James Roe, 33, Herbert Road, Bearwood, Birmingham.
Sheffield and District: W. A. Macdonald, 62, Bannerdale Road, Sheffield.
Scottish: W. H. Bound, 69, Minard Road, Shawlands, Glasgow.
London: H. G. Sommerfield, Woodhouse Road, N.12.
Newcastle-on-Tyne: H. A. J. Rang, 2, St. Nicholas Buildings, Newcastle-on-Tyne.
East Midlands: H. Bunting, 17, Marcus Street, Derby.
Coventry: J. M. Meston, 37, Melville Road.
West Ridings of Yorkshire Branch: A. Love, 232, Gladstone Street, Bradford.

Welsh Engineers' and Founders' Association.

Secretary: E. J. Griffiths, 20, Fisher Street, Swansea.

Bribery and Corruption in the Foundry.

We were minded to deal with this unpleasant subject by two recent personal experiences. The one relates to a foundry foreman, who stated that he was two pounds a week poorer when he changed his job for one at exactly the same salary, as he no longer had commission on the supplies he bought. He assured us that he never had heard of the Corrupt Practices Act. The second was a confession by a foundry supply man that he never gave any "tips" unless they were asked for. The reason why the subject has not previously been ventilated in these columns is because we did not desire to lower the foundry trades in the estimation of the engineering world, but several cases have recently been brought to our notice where firms of high repute insist that modern plant is being prevented from being installed because some manager or foreman is being "got at" by some unscrupulous salesman. As the primary object of the JOURNAL is to aid the technical advancement of the foundry, it is on these grounds and not on the moral aspects, which are perfectly obvious to any normal person, that we feel a warning should be given. The system of giving "pot money" was recently dealt with in the Chesterfield Police Court. This system is a direct incentive for a furnaceman to use as many pots as possible, and makes the comparison of the various brands impossible. Research work on the subject is negatived by the unreliability of the figures for the lives of crucibles as returned from the different works. A crucible salesman selling on long-life properties is on much sounder ground than one relying on pot money.

There are two methods by which the system can be stopped. The first is by taking all buying out of the hands of the foundryman, and the second is by scientific costing and the comparison of the results obtained with those from outside sources. The former remedy does not altogether commend itself to us, for if a foundryman knows his work he should be able to tackle buying better than any other person. It is often an opportunity for him to learn of the latest developments, of new plant installations and their accomplishments on trial and similar information. The second method is the better one. If such items as coke consumption per ton melted, average weight melted per pot, amount of refractories used per month, amount of new sand used per ton of metal melted were periodically charted and meetings were held to discuss all weak points, then not only would better technical information be obtained, but excessive figures would be subjected to both commercial and technical control.

Possibly, the most difficult case is where a seller of plant has given or promised a bribe to a foreman to prejudice him. In such a case there is only one possible remedy, and that is for the man who pays the bill or his responsible representative (for, after all, a "commission man" is not in this category) to learn the practical side of his business or employ a consultant who can be trusted to do it for him. We realise that the above might be dangerous as causing suspicion between employer and employé. This must not happen on any account, as it would be more likely to aggravate rather than to allay the disease. An order that every traveller must be interviewed and a report on the material he is offering, together with a short report on its merits, would help a great deal towards the elimination of the present evil, which, though on the decline, is still far too prevalent.

D

"Moulders" of the Industry.—No. 20.

Mr. John Little.

Mr. John Little, who is a Past-President of the Institute of British Foundrymen, is the Manchester and Liverpool representative of Messrs. Cammell, Laird & Company. He started with this firm some forty-six years ago at the early age of thirteen, as an office boy. Two years later he was apprenticed to pattern making, and later passed into the drawing office. On attaining his majority he was transferred, as a draughtsman, to the company's Penistone works. He returned to the Sheffield works two years later, in 1886. After a short time at the firm's Workington establishment, Mr. Little again returned to the Cyclops Works in Sheffield as chief assistant engineer. In 1902 he was appointed chief engineer to the company, including all its various properties in Sheffield, Coventry, Workington, and several other towns. In 1908 he took over the general management of the Grimesthorpe works.

From an engineering point of view, no one has been more intimately associated with armour-plate manufacture than Mr. Little during the last

Photo by [*Lafayette.*

MR. JOHN LITTLE.

quarter of a century. Nearly twenty years ago he was responsible for the installation of the largest armour mill in the world.

The success which Mr. Little has met with can date from the time he was transferred from the pattern shop to the drawing office. There was no luck attached to this, for from the first day of his apprenticeship he attended evening classes at the old Sheffield Art School, and was actually the first student at the Sheffield Technical School (now the Applied Science Department of Sheffield University). He has consistently taken a practical interest in the technical advancement of engineering and metallurgy. He was one of the founders of the Sheffield Branch of the Junior Institute of Engineers. He joined the Institute of British Foundrymen in 1913, and was President of the Sheffield Branch in 1917 and 1918, and in 1920 he was elected the national President. Mr. Little is also a member of the Institution of Mechanical Engineers.

A REPORT HAS BEEN prepared in the Department of Overseas Trade on the market for wrought-iron tubes and fittings in Poland based upon information furnished by the Commercial Secretary at Warsaw.

Institute of British Foundrymen.

NEWCASTLE BRANCH—JUNIOR SECTION.

The Junior Section visited the works of Messrs. The North-Eastern Marine Engineering Company, Limited, at Wallsend, on October 13. Capt. E. Wood, on behalf of Mr. Summers Hunter, welcomed the guests, who, during a tour of the shops, were particularly interested in a Diesel engine in the course of construction, and especially so in a section of a Diesel bedplate mould in which the cores were in position ready for closing. The patterns for Diesel bedplates and cylinders caused much comment from the section of the visitors interested in pattern-making.

The laboratory, ranking as it does amongst the finest foundry laboratories in the kingdom, being furnished with testing machines, pyrometers, recording instruments, a fully-equipped microscopic outfit, and oil- and gas-testing apparatus, obviously awakened considerable interest in the more technical aspect of their work. At a tea which was offered by the firm, Mr. Clements (President of the Junior Section) read a message of encouragement from Mr. H. J. Young, which pointed out that it was the first body of its kind in the country, and if they would persevere they would always remain the first.

Capt. Wood, in expressing the hope that the visitors had had an interesting and instructive visit, said the managing director, Mr. Summers Hunter, greatly regretted not being able to be present. He pointed out that, unfortunately, there was not much work on at the moment, but hoped that the Junior Section would pay another visit to the works when trade had had time to improve. He said they would notice that there was a good deal of extension work in hand, and these extensions were being made with a view to turning out Diesel engines in the future.

Mr. Clements voiced the thanks of the visitors to Capt. Wood and the North-Eastern Marine Company for the courtesies extended, and took advantage of the opportunity to deliver his presidential address. He pointed out that for many years the foundry trade had been allowed to drift, but that now it was regarded as one of the most important branches of the engineering industry and employers were doing their best to encourage intelligent boys to enter the trade. It had been said that most foundry apprentices did not care to study after their day's work was over, and he thought the reason was that there had been no effort made until now to furnish a method by which the boys might study and investigate their trade in a pleasant manner, and the Junior Section had been formed to supply that method. He hoped they would all gather round and give their support, and show that there were plenty of boys wishing to improve themselves if given encouragement.

Mr. Frier (the Branch Vice-President), in proposing a vote of thanks to Mr. Clements, said that the foundry trade took much learning and that every day fresh difficulties cropped up, but it was very interesting work. He had always thought, however, that the foundry apprentice was neglected so far as education was concerned, but he believed that the inauguration of the Junior Section would remove that difficulty.

BELL BROS. (MANCHESTER), LIMITED, Calder Iron Works, Denton, Manchester, have recently secured a number of contracts, of which the undernoted is a representative selection:—Bergen Baths (Norway), filtration plant and aeration plant; Bacup Corporation, 2 plants 19,500 and 7,350 g.p.h. (filtration); Bolton Baths, filtration and aeration plant; Birmingham Corporation, 4 filtration and aeration plants; British Cotton & Wool Dyers Association, Limited, filtration plant 6,500 g.p.h.; British Soda Company, water softening plant; Cadbury Bros., Limited, filtration plant; Calico Printers Association Strines Printing Company, Limited, water softening plant; Desborough Water Company, filtration plant; Newcastle & Gateshead Water Company, 49 filters, 7,000,000 g.p.d.; Rochdale Corporation, filtration plant; Stoke-on-Trent Baths, filtration and aeration plant; Wrexham & East Denbighshire Water Company, filtration plant, 936,000 g.p.d.; New Sharlston Collieries, water softening plant, 500,000 g.p.d.

The Use of Cast Alloys for the Working Parts of Machinery.

By Mons. Pisek, President of Czecho-Slovakian Foundrymen's Association.

(*Continued from page* 351.)

Alloys of Copper.

The alloys more expensive than those of iron are used in situations where rust or chemical action makes the use of iron impossible. For parts exposed to hard wear and those in which a low coefficient of friction is essential, the more expensive alloys again are employed. Copper alone, on account of its softness and for other reasons, is unsuitable for the manufacture of castings for machine parts. It is difficult to cast; when melted it is always pasty and its fluidity is poor. It greedily absorbs gases, and its high heat conductivity accelerates its cooling and leads to blowholes in the casting. In order to harden copper and to render it easier to cast, it is usual to alloy it with one or more other metals. Copper alloys readily and in all proportions with tin, zinc, and lead, but only to a very small extent with iron. The most important alloys are the copper-tin, known as bronzes, the copper-zinc, or brasses, and the copper-aluminium, or so-called aluminium bronzes.

The copper-tin series of alloys involve many technical complications, but attention, for the present, will be confined to those alloys used for the casting of machine parts, that is alloys containing from 0 to 20 per cent. of tin. Slowly-cooled alloys containing from 0 to 13 per cent. of tin are composed of crystals of copper containing tin in solution. Fig. 52 shows the micro-structure of a slowly-cooled bronze containing 9.86 per cent. of tin. The structure consists of crystals rich in copper deposited in a solidified liquid rich in tin. The structure can be changed by heat treatment: for instance, a bronze containing 20 per cent. of tin heated to 700 deg. C. and quenched in water has its strength and yield point raised whilst its hardness is reduced. For this reason it is usual to break out the castings immediately after pouring, and quench them with water whilst still red hot.

FIG. 52.

The mechanical properties vary according to the tin content. The tensile strength increases very quickly by the addition of tin, a maximum being obtained when the tin reaches 7.5 per cent. The yield point increases a little, as the ultimate tensile strength is raised, and reaches a maximum when the tin content is 6 per cent. above that proportion, the yield point falls rapidly, becoming eliminated when the tin has reached 20 per cent. Increasing the proportion of tin also increases the hardness of the alloy, until at 38 per cent. of tin a chemical compound is formed and the hardness reaches a maximum. The tensile strength of a slowly-cooled bronze containing 5 per cent. of tin is about 14 tons per sq. in. with an elongation of 20 per cent. If this alloy is heated to 500 deg. C. and quenched in water the tensile strength is increased to about 16 tons per sq. in., at the same time the elongation remains almost unchanged. For a bronze containing 20 per cent. of tin and slowly cooled the tensile strength becomes about 23 tons per sq. in. with an elongation of 0.8 per cent. By reheating this alloy to 500 deg. C. and quenching in water the tensile strength rises to 25 tons per sq. in., whilst the elongation has increased to 15 per cent.

Deoxidising Copper Alloys.

Both copper and tin are readily oxidised by atmospheric air; oxides of copper and tin are formed, the former remaining in the liquid and the latter escaping to some extent. The presence of these oxides in the molten metal, particularly when sulphur is present, gives rise to gases which make the castings porous. To avoid this it becomes necessary to deoxidise the molten metal. For this purpose phosphorus is employed, and is added in the form of phosphor-copper. Other deoxidants which may be used are manganese, as cupro-manganese; silicon, as cupro-silicon; zinc and aluminium. Only sufficient deoxidiser to reduce the oxides should be added. Sometimes even a small excess of deoxidant is sufficient to render the alloy brittle; this is true for copper. Bronzes which have been deoxidised by phosphorus are called phosphor bronzes; they must not contain any phosphorus, which has been added for the sole purpose of deoxidising. As a result, phosphor bronzes are dense and better able to withstand the action of acids and salt water than are the ordinary bronzes. The bronzes most frequently employed are the alloy containing 5 per cent. of tin, which is ductile but rather difficultly fusible. It is used for casting certain parts of turbines. A bronze with 8 per cent. of tin is tough and strong; it is used for parts demanding toughness and strength without being hard. With 10 per cent. of tin the alloy is more fusible, whilst being very strong and tough; it is employed for valves and pump parts. A hard bronze is that containing 12 per cent. of tin, an alloy very suitable for such parts as the buckets of Pelton wheels. It is highly resistant to the action of acid, mine waters and, on account of its hardness, is used for gear wheels. Bronzes containing between 9 and 12 per cent. of tin are called gunmetals. Bronzes with a tin content from 14 to 17 per cent. are very hard, brittle, and easily fusible; they are used as anti-friction metals. Since, in ordinary practice, pure metals are not used, the bronzes contain various impurities in small quantities: lead, zinc, iron, and nickel are examples. In certain circumstances proportions of these metals are added to bronze

FIG. 53.

to impart special properties. For example, lead is added when the article is to be machined; lead makes the alloy more easily machinable, and, at the same time, denser. When the lead is above 2 per cent. the tendency to liquation is increased. Nickel and zinc oppose liquation. For valves designed for light pressures a suitable alloy would be: Copper, 84; tin, 10; lead, 4; antimony, 2. When lead is a constituent of an alloy, phosphorus cannot be employed as a deoxidant, because it encourages the liquation of the lead. The best bronzes are expensive because of the amount of tin they contain. For this reason, and where great strength is not required, it is usual to replace a portion of the tin by the much cheaper metal—zinc. The bronzes then become more fusible but also more brittle. There are a great many of these alloys, for example, an alloy suitable for low-pressure valves is: copper 85, tin 8, zinc 5, lead 2; for bearings; copper 83, tin 12, zinc 5. For those alloys which contain a large proportion of lead, it is necessary to add more zinc in order to prevent the liquation of the lead. For the same reason masses of metal in the casting must be avoided. Contraction is not very great and can easily be dealt with.

The Brasses.

The brasses are alloys of copper and zinc. Zinc is miscible with copper in all proportions. Attention will be confined to those alloys used for machine parts, that is, alloys containing up to 45 per cent. of zinc. The mechanical properties depend upon the composition and the structure, the latter factor can be modified by heat-treatment and rate of cooling. The addition of zinc to copper raises the tensile strength, but less rapidly than would the attention of the same proportion of tin. With a certain structure resulting from the addition of 45 per cent. of zinc the alloy attains its maximum tensile strength, 12 tons per sq. in. The addition of zinc to copper up to a proportion of 30 per cent. increases ductility; when that proportion is exceeded the ductility falls off rapidly and the hardness increases, but to a smaller degree than is attained by the same proportion of tin. The elastic limit is very small, an important factor when considering design. Alloys containing 35 to 42 per cent. of zinc are malleable both hot and cold. Brasses with a zinc content of 42 to 48 per cent. are very malleable when hot. The higher the zinc content the more fusible does the brass become, but these fusible alloys are hard and brittle. The contraction of brass decreases as the zinc content is raised: it varies from 2.2 to 1.6 per cent. Fig. 53 shows the micro-structure of a brass of the following composition: copper 60.02, zinc 38.6, lead 1.20, manganese 0.06; this is the metal of the rejected valve body, shown in Fig. 1, after re-melting. A great advantage of the copper-zinc alloys is that they are not subject to liquation. For valves, used with slightly acid liquids, a suitable alloy is: copper 70, zinc 30, which has a tensile strength of about 13 tons per sq. in. and an elongation of 45 per cent.

Small additions of other metals have a great influence on the properties of the brass series, but care must be taken to guard against excess of the added metal, otherwise chemical compounds may be formed which will render the alloy useless for its intended purpose. For a cheaper brass, suitable for cocks, more zinc may be added, as for example: copper 60, zinc 37, lead 3. The lead, too, serves as a deoxidant. The addition of a further 1 per cent. of lead reduces the malleability of the alloy, but that is not of great moment for brass cocks.

Aluminium Brass and Manganese Bronze.

By adding from 1 to 2 per cent. of aluminium to the brass, aluminium brass is obtained; this addition of aluminium increases the ultimate tensile strength as well as the elastic limit. An aluminium brass containing copper 65, zinc 33, aluminium 1 to 2, is highly resistant to the action of sea water. An addition of 0.5 to 1.5 per cent. of iron increases the malleability of brass. A very good and moderate-priced brass is copper 58, zinc 40, iron 1, aluminium 1. The tensile strength of this alloy runs up to 13 to 16 tons per sq in., with an elongation from 10 to 15 per cent. If, to a brass having a small iron content, aluminium and manganese are added, the so-called manganese bronze results. There are a great many alloys in this series of which the following is a typical example: copper 53 to 54, zinc 36 to 38, iron 0.5 to 1, aluminium 1, manganese 3 to 4; this is a very hard alloy but malleable when hot. It has an ultimate tensile strength of 32 to 38 tons per sq. in., an apparent elastic limit of 16 to 22 tons per sq. in., an elongation of 15 to 10 per cent., and a reduction of area 25 to 20 per cent. Fig. 54 shows the structure of a similar alloy, as cast, and of the composition: copper 60.64, zinc 32.81, iron 1.12, aluminium 0.99, manganese 2.79, lead 0.85, tin 0.45. Fig. 55 shows the same alloy forged. In the forged state the ultimate tensile strength is almost the same as when cast, but the elongation is increased. Fig. 56 shows the micro-structure of a manganese bronze slowly cooled and of the composition: copper 53.06, manganese 2.42, zinc 41.60, lead 1.08, aluminium 1.02, iron 1.15. These bronzes have a great tendency to liquation and a high rate of contraction

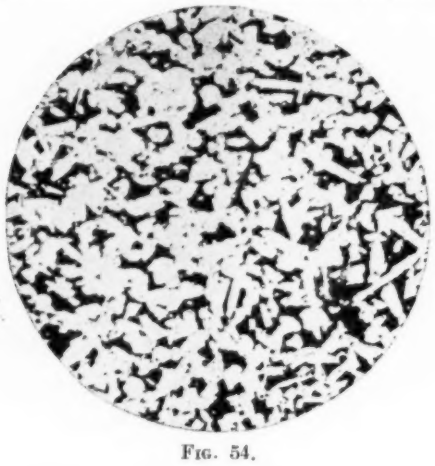


Fig. 54.

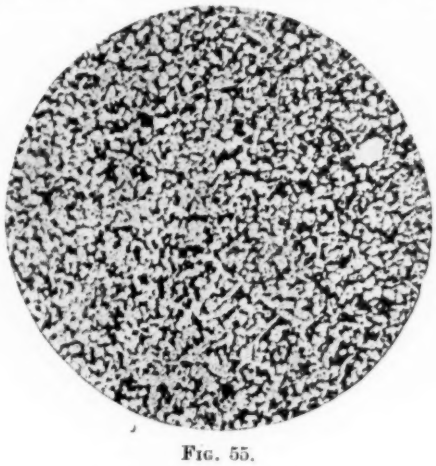


Fig. 55.

Aluminium Bronzes.

For cast parts alloys of copper and aluminium are also used with an aluminium content up to 11 per cent. The addition of aluminium to copper increases the tensile strength and hardness to a greater extent than results from the addition of an equal proportion of tin. With aluminium up to 9 per cent., the alloys have a high tensile strength and great hardness. Fig. 57 shows the structure of a slowly-cooled alloy of composition—copper 84.34, aluminium 10.53. The strongest alloy is that containing 10 per cent. of aluminium, the tensile strength being 32 to 38 tons per sq. in. The cold working properties of the alloy diminish with the aluminium content. With an aluminium content of 10 per cent. the alloy cannot be cold worked. Above 10 per cent. of aluminium the alloy becomes more brittle. Aluminium

bronzes are lighter than the ordinary bronzes. A great disadvantage of this series of alloys is the high contraction, up to 1.8 or 2 per cent., which increases with the proportion of aluminium. The aluminium bronzes are strongly resistent to the action of sea water. The alloys must be cast at as low a temperature as possible, because slow cooling allows the formation of large crystals which are weaker. For this reason aluminium bronzes are cast in green sand. Owing to the high contraction, masses of metal must be avoided in design and large feeder heads and risers must be provided. The addition of nickel to the 10 per cent. aluminium alloy increases the toughness. The addition of manganese to the 10 per cent. alloy greatly increases its strength; the composition might be: copper 83 to 85, aluminium 10, iron 0.5, manganese 1 to 1.5, nickel 2 to 3. The ultimate tensile strength of this alloy is 22 to 32 tons per sq. in., apparent elastic limit 13 to 16 tons per sq. in., elongation is 25 to 20 per cent., reduction of area 30 to 20 per cent. This alloy can be forged at a temperature of 700 deg. C. In the forged state the ultimate tensile strength becomes 35 to 45 tons per sq. in., apparent elastic limit 19 to 25 tons per sq. in., and the elongation 15 to 10 per cent. Fig. 58 shows the structure of this alloy slowly cooled. The Brinell hardness number is 159. With rapid cooling this alloy becomes very hard. Fig. 59 shows the same alloy cooled quickly, the Brinell hardness then being 272. The alloy is

FIG. 56.

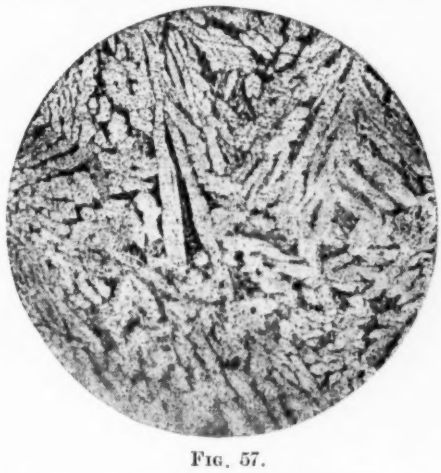


FIG. 57.

very fusible, but the contraction amounts to 2 per cent. Large feeder heads and risers must be provided. The so-called "Rubel" bronzes are brasses containing, in addition manganese, iron, aluminium, and nickel.

Antifriction Alloys.

The preparation of the antifriction series of alloys is a very important section. A white metal should meet the following conditions: A very low coefficient of friction; a sufficiently high resistance to compression; the alloy must be less hard than the journal. Cast-iron is not suitable for an antifriction alloy because of its high coefficient of friction. The alloys usually employed are: Alloys of copper, alloys of tin—the so-called white metals, and combinations of these two groups. The copper alloys consist of additions of tin, zinc, lead and antimony. These are the alloys suitable for bearings subjected to heavy pressures because of the strength of the copper. Their drawback is that replacements are expensive. If some foreign substance works in between the bearing and the journal the latter is damaged. The alloys most usually employed are those containing copper, tin, zinc and lead. For high speeds the white metals are employed; they are softer than the copper alloys, and if anything gets in the bearing it is pressed into the soft metal instead of damaging the shaft. White-metal bearings are sometimes cast in position. One disadvantage of this group is that a rise in temperature encourages the growth of the crystals, with the result that friction is increased. If the temperature of the bearing runs up to the melting point of the alloy, the bearing melts out. To guard against this event, and in order that the shaft may not then run on the iron pedestal, it is customary to employ a combination of the two groups of alloys. The bearing "brass" is made of bronze, lined with white metal. The most important of the white metals are those containing tin. Tin alone is very soft, but the addition of copper and antimony hardens it and increases the strength. A small addition of copper raises the hardness but does not make the alloy so brittle as does a like proportion of antimony. The best alloy is 80 per cent. tin, 12 per cent. antimony, 8 per cent. copper, and its microstructure is shown by Fig. 60. The structure consists of three parts, hard, brittle crystals of a tin-copper compound; these friable crystals leave holes in which the lubricant is retained; crystals of a tin-antimony alloy, harder than the tin itself but not so hard as the tin-copper crystals; finally there is a ground mass of almost pure tin. The crystals are embedded in this mass. The size of the crystals depends on the rate of cooling and the composition of the alloy. Fig. 61 shows the same alloy as Fig. 60, but reheated to a temperature of 280 deg. C. for one hour and slowly cooled. Owing to the high price of tin, the alloy mentioned is only used for high speeds and high bearing pressures. For less exacting conditions, it is usual to replace part of the tin by lead, giving an alloy of copper 12, antimony 18, tin 40, lead 30.

Pure lead is unsuitable for use as an antifriction alloy; it is hardened by the addition of antimony. Although lead and antimony are miscible in all proportions in the liquid state, this is not so in the solid state. From an alloy containing more than 13 per cent. of antimony the excess metal separates, in which case the alloy contains crystals of antimony embedded in a ground mass of a lead-antimony alloy. The most economical is an alloy containing about 20 per cent. of antimony, a by-product from the production of silver. As the brittleness of the alloy is increased by a higher content of antimony, it is usual to add a small proportion of tin which reduces the brittleness. During the war the Austrians made use of the following alloy as a bearing metal: lead 78, antimony 17, and tin 5 per cent. If the proportion of antimony is greater than 20 per cent., the metal becomes very brittle; tin must then be added as, for example, lead 65, antimony 23, tin 12. Alloys containing zinc would be harder than those of lead but they are weak.

Alloys of Aluminium.

Aluminium is the lightest of the common metals, having a specific gravity of 2.6 as cast. At ordinary temperatures the metal does not oxidise and resists the attack of sulphuric and nitric acids, but it is quickly attacked by hydrochloric acid and alkalis. Aluminium is soft, ductile, and very malleable. In the cast condition the tensile strength varies between 7 and 9.5 tons per sq. in., with an elongation of 4 to 5 per cent. The melting point is round about 650 deg. C., and its specific heat is greater than that of the other metals. Its heat conductivity is 36, about half that of copper. The latent heat of fusion is greater than that of any other metal, so that a

large quantity of heat must be supplied to melt it, especially since at its melting point it is very sluggish. It is necessary, therefore, to superheat the metal to render it really fluid. Contraction of aluminium amounts to 1.8 per cent. If slowly cooled, the metal becomes crystalline. It can be cast in chills or in sand. When chill-cast the structure is fine, owing to the rapid cooling. Aluminium is difficult to cast because during solidification it passes through a pasty stage. In many respects the difficulties encountered are the same as those met with in casting steel. Owing to the high latent heat of fusion, cast aluminium cools slowly. Aluminium alone is too soft for castings;

FIG. 58.

it may be hardened by the addition of other metals—copper, zinc, iron, lead, and manganese. Zinc increases the hardness, but if present to the extent of 25 to 30 per cent. the alloy becomes very brittle, its specific gravity is also increased. The best material for hardening aluminium is copper, which does not render it so brittle as does zinc. Tin, iron, and manganese increase both strength and hardness. The addition of these metals also makes the aluminium more fluid. Aluminium alloys are used to the greatest extent in internal combustion engines, especially those for aeroplanes. A suitable alloy for aero-engine crankcases is aluminium 89, copper 3, iron 1.5, zinc 6.5;

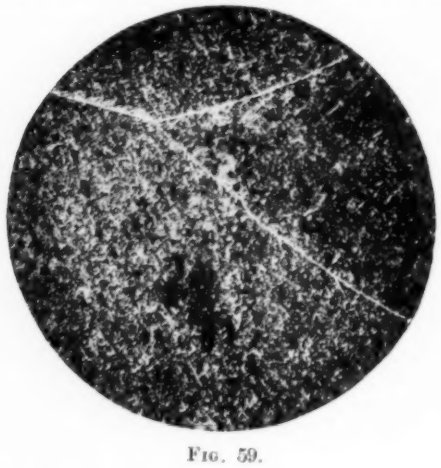


FIG. 59.

the specific gravity of this alloy is 2.88. Other alloys for the same purpose are: (1) Aluminium, 86.04; zinc, 9.65; copper, 2.68; tin, 0.06; iron, 1.25; lead, nil; and silicon, 0.32 per cent.; (2) aluminium, 88.22; zinc, 5.97; copper, 3.63; tin, 0.13; iron, 1.75; lead, 0.08; and silicon, 6.22 per cent. The iron is added in a very pure state in the form of nails Owing to the silicon it contains, cast iron is unsuitable for addition. For motor-car engine crankcases the amount of zinc is increased. Aluminium and magnesium form together a remarkable series of allows; they are even lighter than aluminium alone, the specific gravities being 2.4 to 2.57. They contain from 2 to 12 per cent. of magnesium. Owing to the high heat-conductivity of aluminium, its alloys are very suitable for the casting of pistons for internal-combustion engines. If cast iron or steel pistons are employed the heat is not conducted away sufficiently rapidly, with the result that the top of the piston becomes so hot as to reduce the efficiency of the engine. Alloys for the manufacture of these pistons must satisfy very exacting tests. It is important that the mechanical strength should not be reduced on account of the high working temperatures to which the pistons are subjected. The pistons are cast in chill moulds. A few of the alloys used for these parts are: (1) Aluminium,

FIG. 60.

89; copper, 8; tin, 2; and zinc, 1 per cent.; (2) aluminium, 89; copper, 10; and manganese, 1 to 2 per cent. The influence of the copper is the predominant factor in imparting the necessary properties for this purpose. The casting of aluminium alloys presents difficulties which have already been mentioned. Magnesium is used as a deoxidant, 0.2 per cent. being added before casting. Owing to the great contraction of these alloys the mould must be elastic to some extent. A few minutes after solidification, the castings must be knocked out, not only to allow contraction but also to accelerate cooling. In order to prevent the entry of slag into the mould it is usual to

FIG. 61.

thicken it by the addition of zinc chloride before casting.

From all that has been said in this paper it is obvious that the founder's art is one demanding a wide knowledge of many technical subjects.

MR. HERBERT MARSHALL, managing director of the engineering firm of Marshall, Sons & Company, Limited, of Gainsborough, announces that there is not the slightest truth in the announcement which has appeared in certain sections of the Press to the effect that his firm has been completely taken over by a Sheffield firm.

Desulphurisation of Foundry Coke.*

By A. D. Young (Burnley Gas Department).

A perfect coke would consist of carbon together with very small quantities of hydrogen, but in actual practice it contains a number of impurities, such as nitrogen, sulphur, phosphorus and ash. Sulphur is usually present in amounts varying from 0.5 to 1.75 per cent. To ascertain in what form these impurities exist, it becomes necessary to make an examination of the coal prior to the coking process.

The coal may be said to contain as impurities dirt, shale, iron pyrites, and the ash of the coal substance. The larger percentage of the first three are removed in the washing process, but the mineral ash remains in the coal after washing.

Looking at the occurrence of the sulphur in the original coal, it may be said to exist as four types of sulphur compounds.

Inorganic Sulphur (distributed irregularly).—(1) Pyrites and marcasite, FeS_2; (2) sulphates soluble in dilute hydrochloric acid.

Organic Sulphur.—(1) That present in those portions of the coal soluble in phenol and termed "Resinic" organic; (2) that present in the portions of coal insoluble in phenol, termed "humus organic," and shown by chemical reactions to be related to the humus compounds of the coal substance.

During the coking process the pyrites and marcasite are decomposed into ferrous sulphide, sulphur, and pyrrhotite (magnetic pyrites of composition between 5 $FeS.Fe_2S_3$ and 6 $FeS.Fe_2S_3$). The sulphur is partially retained by the coal, and partly combines with hydrogen to form sulphuretted hydrogen found in the gas. The reaction reaches a maximum between 400 and 500 deg. C.

The sulphates are reduced to sulphides during the coking process, the reaction being complete at 500 deg. C.

The resinic sulphur remains in the coke in a changed form.

The humus sulphur is partly volatilised, part of the sulphur remaining in the coke in a changed form.

Thus it can be said that whilst the coke remains in the reducing atmosphere of the oven, sulphur is present in two forms:—

(1) *Major Portion.*—As a solid solution of sulphur in carbon.

(2) *Remainder.*—As ferrous sulphide with a small quantity of calcium or magnesium sulphide.

During the quenching process the sulphur in the coke is subject to oxidation, a portion of the metallic sulphides being oxidised to sulphates and free sulphur, this free sulphur being retained in the coke, while that in solid solution remains unchanged.

If the coke can be quenched in a reducing atmosphere, no oxidation of the sulphides would take place; and also if coke quenched in the usual way is reheated in a reducing atmosphere, the sulphur existing in sulphates will revert to its original form

Having seen the forms in which the sulphur exists in the coke, the processes and proposals for its removal can be examined.

Roasting Coke.

As explained above, during the quenching process the sulphides are oxidised to sulphates and free sulphur, and fifty years ago Phillipart published the results of his work on the desulphurisation of coke by roasting in air. These results, in the light of present-day knowledge, are not of great use. It must be remembered that any roasting process will not touch the sulphur in solid solution, and only the removal of the sulphide-sulphur would be possible.

A. R. Powell, of Chicago, who has devoted much time to the desulphurisation of coke by air, has shown by his results that the processes necessary are not easy of accomplishment in practical working. Powell first determined the best temperature for the oxidation of the ferrous sulphide in the coke, with the least loss of coke by the process, by passing air over powdered coke heated to certain temperatures as shown in Table I.

TABLE I.—*Showing Result of Powell's Experiments.*

Temperature.	300° C.	400° C.	500° C.	600° C.
Oxidation of ferrous sulphide	Slow	More quickly	Completed in a few minutes	Slow'r than at 500° C.
Loss of coke ..	Nil	Practically nil.	Under 1%	Appreciable.

Evidently 500 deg. C. was the temperature giving the best results. Powell's work also showed that any process for the removal of sulphur must be a two-stage one.

Firstly.—The oxidation of the ferrous sulphide into sulphate and free sulphur.

Secondly.—The removal of the free sulphur so formed, which has been absorbed on the coke surface. For the second stage of the process he tried three different methods:—

Vacuum.—Applying a vacuum to the heated coke during the roasting period. Little or no sulphur is extracted from the coke by this method.

Higher Temperature.—Raising the temperature had little added effect in the elimination of free sulphur. The industrial objection to the method is the reheating of the coke mass to a temperature higher than that necessary for the first process.

Further or Secondary Roasting.—By passing air through the coke beyond the point where the sulphides have been oxidised to free sulphur there is some added elimination of free sulphur. The objection is the excessive formation of sulphates in the coke.

He concludes that the industrial elimination of sulphur from coke by air is not practicable, due to the tenacity with which the free sulphur is held by the coke.

Admission of Air during Carbonisation.

Campbell in 1917 showed that the sulphur content of coke made in beehive ovens was not less than that of coke made in by-product ovens, as might be thought from the formation of sulphur dioxide, due to air admitted to the oven in the beehive process.

A writer in the "Gas World" last year, referring to Campbell's writings, proposed the addition of a small amount of colloidal silicic acid to the coal before coking as a means of lowering the sulphur content. The coal ash is basic in character, and, as Campbell remarked, that the sulphur from the sulphates in the coal is not driven off during coking, and, with a basic ash, a low-sulphur content is impossible.

Quenching with Water.

On quenching the coke with water at the expiration of the coking period a very small amount of sulphur is driven off in the form of sulphuretted hydrogen (H_2S).

The effect is only slight, due to the rapid decrease in temperature of the coke, the conditions being the reverse to those required for the rapid evolution of sulphuretted hydrogen. The cooling of the coke at all times must be done quickly, and the decomposition of organic sulphur to form sulphuretted hydrogen takes place only slightly below 500 deg. C.

Possibly further investigation into the quenching of coke may lead to improved results. The above phenomena leads us to consider the effect of steam and hydrogen on the elimination of sulphur.

Elimination of Sulphur by Steam.

The desulphurising action of steam requires a high temperature for the necessary reaction to take place, and, under such circumstances, water gas is formed, resulting in a lowering of the tem-

* A Paper presented to the Burnley Section of the Institute of British Foundrymen, Mr. G. Barnes presiding.

perature of the coke. This means also a considerable loss of coke, due to the carbon in the water gas so formed.

Any process using steam as a desulphurising agent will thus require the addition of external heat to the coke under treatment to keep up the necessary temperature for the reaction.

The difficulties of keeping a large mass of coke at the correct reaction temperature, together with the capital and labour charges on the plant, will retard practice with this agent.

In all probability the coke-oven manager will give more serious attention to this question as the "steaming" of the charge of partially carbonised coal in the coke oven becomes more common, in his endeavour to obtain a larger yield of by-products.

Under such conditions the coke will be treated with steam before being expelled from the oven, but it must be understood that such treatment will not give a coke free from sulphur.

Investigation into the Question of the Gasification of Coke by Steam.[1]

Pexton and Cobb (Inst. Gas. Eng., 1923) showed the impossibility of completely desulphurising coke unless practically all the coke under treatment is gasified, but that much of the sulphide-sulphur could be driven off in the early stages of gasification, especially when an excess of steam is present. They also remark that the maximum extent to which cokes could be desulphurised with but little gasification of the coke seemed to be governed "within limits" primarily by the proportion of sulphide-sulphur in the material.

Elimination of Sulphur by Hydrogen.

Much attention has been devoted in America to the action of hydrogen and coke-oven gas as desulphurising agents. In coke-oven gas the active desulphurising agent is hydrogen, which reacts with the organic sulphur in the coke, and at high temperatures (1,000 deg. C.) removes most of the sulphur without affecting the character of the coke. The time of treatment by hydrogen would be fairly long, and the practical difficulties many, whether the coke be treated in the oven or afterwards.

Some work has been done in this country on a laboratory scale by Monkhouse and Cobb (Trans. Inst. Gas Eng., 1922) on the liberation of nitrogen and sulphur from coal and coke. Cokes made at 500, 800 and 1,100 deg. C., corresponding to low, medium, and high temperature cokes, were subjected to the action of currents of nitrogen, hydrogen and steam at certain temperature stages. The results on the high-temperature coke are those which directly concern us, and are given in Tables II. and III.

TABLE II.—*Influence of H on the S Content of High-Temperature Coke made at* 1,100 *deg. C.*

Treated with hydrogen gas at a temperature of	Sulphur obtained as H_2S in per cent. of total sulphur of coke.
600°C.	1.8%
800°C	11.4%
1,000°C.	12.1%
	25.3%

Sulphur in Coke 1.30 per cent.

TABLE III.—*Influence of H and Steam together on the S Content of Coke made at* 1,100 *deg. C.*

Treated with hydrogen and steam at a temperature of	Sulphur obtained as H_2S in per cent. of total Sulphur of coke.
600°C.	2.3%
800°C.	38.3%
1,000°C.	26.6%
	67.1%

The above results show that there are great possibilities in the use of steam and hydrogen for the elimination of sulphur at high temperatures, but from the graphed results (Fig. 1.) the time taken to attain the results is long. This feature coupled with the large plant for practical working will not allow such a process to be a financial success at present.

Treatment of the Coke by Acids.

The treatment of the coke by certain mineral acids would remove the whole of the sulphide-sulphur, the most convenient acid for the purpose being hydrochloric. Unfortunately the commercial qualities contain sulphur in such amounts that the ultimate result would be nil. Acetic acid has been found to give better results than hydrochloric which would be beneficial in more ways than one, as hydrochloric acid, if applied to the coke in the

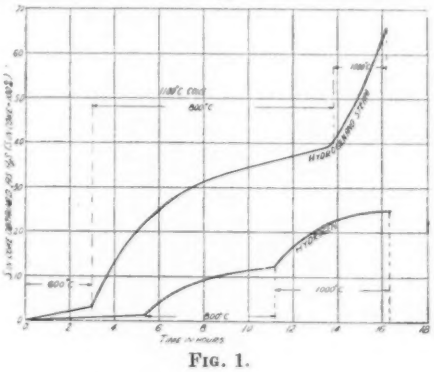


FIG. 1.

oven, would add further troubles to the coke-oven manager's lot. The acid treatment could also be applied to the coke after discharge from, instead of when in, the oven, but the cost of pure acid renders the process prohibitive at present. Up to the present time no satisfactory solution to the problem of desulphurisation of coke has been found.

Desulphurisation in Cupola Practice.

About five years ago Vollenbruck, in "Stahl und Eisen," gave the results of his practical work in Germany on the behaviour of sulphur in the cupola, and describes a set of experiments dealing with the absorption and removal of sulphur by the different additions of lime in the cupola, as given in Table IV.

TABLE IV.—*Sulphur Reduction in the Cupola.*

Limestone additions in per cent. of the weight of coke.	Sulphur content of the cast iron.	Sulphur content of slag.	Lime content of slag.
%	%	%	%
0	0.124	—	—
3	0.120	0.057	10.90
6	0.118	0.057	13.04
9	0.111	0.061	14.26
12	0.087	0.062	14.74
15	0.083	0.062	16.15
18	0.084	0.062	16.40
21	0.087	0.062	18.36
24	0.084	0.078	19.15
27	0.088	0.116	23.65

The cupola practice was uniform throughout the tests, and charges 1,650 lbs. of large coke, 1,320 lbs. of iron, and 99 lbs. of fine coke were employed. Additions of lime were made, and

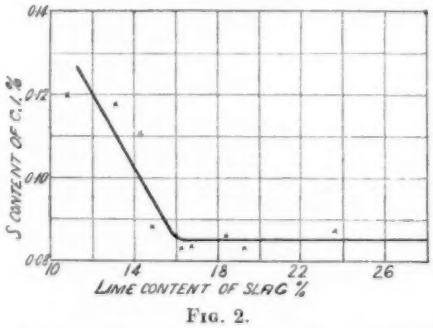


FIG. 2.

varied as given above in the trials. The tests were taken 15 minutes after the appearance of the first metal at the receiver, and at the junction of this and the cupola.

The charge had less than 0.05 per cent. of sulphur at the most. The lowest sulphur content of the iron after melting was 0.088 per cent., and of this, 0.03 per cent. comes from the coke and cannot be prevented by the addition of lime (Figs. 2 and 3).

The slag is enriched with sulphur up to an addition of 27 per cent. of lime, but the removal of sulphur from the iron ceases when the slag contains 14.74 per cent. of lime. Further additions

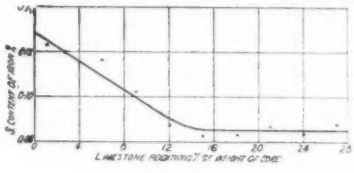


FIG. 3.

of lime are useless beyond this point, as the extra lime only takes up sulphur from the gases leaving the cupola.

Vollenbruck also gives some results of desulphurisation by varying blast pressures, and also results as to the effect of lime and manganese silicates.

Discussion.

MR. PELL said Mr. Young's explanation was a very good one, but perhaps too technical for the purpose of a foundryman, who was not concerned with the production of coke in the oven, except that if the makers could manage to supply a coke with a low sulphur content his problem would be simplified and he would get better results. The practical question from his point of view was, how could he desulphurise a furnace coke which contained a lot of sulphur. His (Mr. Pell's) own experience had been that they sometimes received very poor coke with sulphur far in excess of normal. Was there any means by which that could be removed before the coke was used in the cupola? At the Manchester meeting one member stated that he put a high sulphur coke into the furnace, heated it up, then drew it out of the furnace and quenched with water. In that way he eliminated some of the sulphur.

Another matter which had been a bone of contention for some time was the distinction between two kinds of coke, one from beehive ovens, the other the coke produced after the by-products of the coal had been taken out. Was there any material difference in the constitution of the coke so far as use in the foundry was concerned? They were told that the by-products had a commercial value. Did the removal of them affect the heating properties, or did the beehive oven produce a heavier weight of coke?

Impracticability of Vollenbruck's Work.

MR. JACKSON, referring to the table showing the results of Vollenbruck's experiments with the addition of limestone, said he did not see that they really served any good purpose in foundry practice. It was quite removed from the general practice.

MR. YOUNG, agreeing, said he had included them because he wanted to show that although nothing had been accomplished from the point of view of desulphurisation by coke-oven managers, attempts had been made to do it in the foundry itself.

A small amount of sulphur could be eliminated by heating coke in the oven and quenching with water; it was equivalent to roasting or heating in air and quenching with water. If air was admitted into the furnace for heating, the coke over there would be no benefit.

Beehive and By-Product Coke.

He was not going to be drawn into making any statement as to whether the beehive or the by-product oven coke was the better. It was purely a matter of opinion and the treatment of the coal during treatment. But in this country the number of beehive ovens was not increasing, and the by-product ovens were increasing, slowly at present, but the rate of progress would become more rapid. In German practice the beehive oven was practically extinct. To some extent it depended on which type would best suit a particular case.

Apart from the question of purity, the coke structure was a matter for consideration. A process which left the coke too hard to burn, that is, incombustible, would be useless. A paper read before the Iron and Steel Institute this year by Messrs. Sutcliffe and Evans opened up very big possibilities, and if their statements turned out to be correct the present ideas of the combustibility of coke would have to be altered to some extent. Hitherto the demand had been for a hard quality of coke which would resist abrasion and not break down in the furnace. On the other hand, they did not want a coke which was going to take a lot of burning, because the more combustible it was the more the heat that was given off, and associated with quicker melting. Sutcliffe and Evans took an ordinary well-washed coke, ground it very finely, practically to powder, and under pressure of about 10 tons per sq. in. compressed it without a binder into small oval blocks. It was carbonised in any high temperature plant. They claimed that by so doing they eliminated some of the questions regarding the natural structure, and they obtained a fuel which would burn after the type of charcoal. The property of burning depended to a great extent upon the internal structure.

THE CHAIRMAN stated that the question of the two kinds of coke was brought up at a recent Manchester meeting. One member who used all sorts of coke said he could not find that there was any difference.

MR. YOUNG said the smoke problem would have to be dealt with, and probably in time it would lead to the use of smokeless fuel. To a great extent that would cut out a great many beehive ovens in the future.

MR. PELL remarked that his point was that if it was possible to get equally good coke and at the same time get by-products which had a commercial value, that process should lead to the scrapping of the beehive ovens.

MR. YOUNG said one could get the same chemical composition of coke, whether it was made by the beehive process or with recovery of the by-products. The difference was that in the one case the by-products helped to supply the heat for carbonisation, in the other they were led from the oven, the by-products recovered, and the gas led back to the ovens. The probabilities were that in the future the necessity for coal conservation would to a great extent force the coke-oven people to adopt the latter in the interests of national economy. The chemical composition of coke made either by the beehive or recovery oven would be about the same if the coal was from the same source and coked at the same temperature. The only real difference would be in the physical structure and its shape. The combustibility of cokes will vary, due to the differences in physical structure.

A vote of thanks to Mr. Young was passed unanimously.

Catalogues Received.

Rust Prevention.—We have received from the Rowe Chemical Company, of 13A, Newbury Road, London, E.4, a sample bottle of Rustofite, together with a treated specimen of metal. Rustofite is a preparation designed to prevent the rusting of metals. Treated metals are stated to withstand acid fumes, brine, or any weather condition likely to be encountered by machinery during transit. The material caters for a very large market, and on the score of cleanliness alone should largely replace the grease with which steel bars are doped when packing for export.

THE BRITISH CHILLED IRON AND STEEL COMPANY, LIMITED, have purchased the business of the British Griffin Chilled Iron and Steel Company, Limited, and intend to operate the works at Barrow-in-Furness on the same lines as before. The company have also acquired the business of the Imperial Castings Company, carried on by Mr. A. F. Tosh and Mr. H. Orrell at Askam-in-Furness. Messrs. Tosh and Orrell are the first directors of the British Chilled Iron and Steel Company.

XUM

Tests on Piping and Shrinkage in Cast Iron.

Dr. O. Bauer and K. Sipp describe in a recent number of "Stahl und Eisen" some tests which they have carried out in order to determine the effects of silicon, manganese, phosphorus and sulphur on cast iron. Preliminary experiments carried out on a Swedish charcoal iron containing total carbon 3.35 per cent., traces of silicon, manganese 0.20 per cent., phosphorus 0.07 per cent., sulphur 0.017 per cent., and remelted in the crucible with varying percentages of silicon, had shown the lowest percentages of silicon to be 0.5 per cent. in order to get a grey cast iron from this composition. Three series of test melts were therefore made by adding the silicon in the form of 80 per cent. ferro-silicon, and with the following increasing percentages of manganese, phosphorus and sulphur:—Manganese, 0.95, 1.0, 1.5 and 2.5 per cent.; phosphorus, 0.5, 1.0, 1.5 and 2 per cent.; sulphur, 0.05, 0.15, 0.25 and 0.30 per cent. Additionally a special melt was made with the usual percentages of other constituents and the standard 2 per cent. (approximately) of silicon.

In order to ensure proper comparison, one bar was cast as hot as possible and one as cold as possible from each crucible. Special arrangements were provided for measuring the casting temperature, and the shrinkage curves were recorded automatically on the drum of a special shrinkage recorder. When thoroughly cold, the bars were tested for external piping, and then split in two to expose the internal pipe.

The curves shown in Figs. 1, 2, 3 and 4 illustrate the percentage shrinkages and volumes of pipes found in the test bars.

As regards the influence of the several elements on the tendency to piping, the writers make the following remarks:—(1) An increasing percentage of silicon tends generally to diminish the tendency of the metal to pipe. The effect is the same as in the shrinkage of the metal. (2) The tendency to the formation of pipes first increases with increasing percentages of manganese, then it drops again after 1.20 per cent. Mn. is reached. It is exactly the opposite with shrinkage. (3) Increasing phosphorus contents tend to decrease the tendency to piping, and also decreases the total shrinkage. (4) High-sulphur contents increase the tendency to piping, and are therefore detrimental to the properties of cast iron, both from the point of view of increased shrinkage and the tendency of the material to segregate.

The results of the tests show that there is undoubtedly a connection between the shrinkage of cast iron and the tendency to "pipe"; this is demonstrated by the fact that the substances, such as silicon and phosphorus, which tend to reduce total shrinkage, also decrease the tendency of pipes to form. At the same time, the method of casting, *i.e.*, with the metal as hot or as cold as possible, the method of cooling, and the shape of the casting itself all have their effect on the factors under discussion.

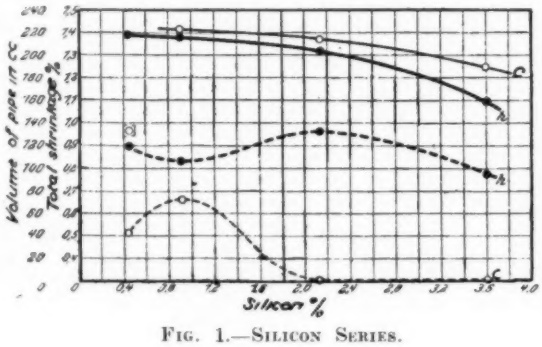


FIG. 1.—SILICON SERIES.

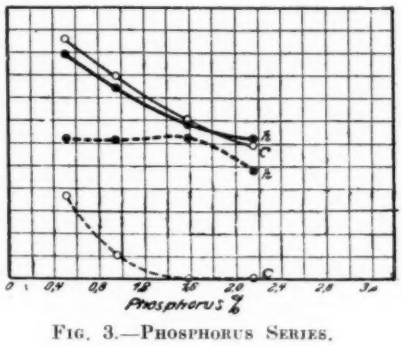


FIG. 3.—PHOSPHORUS SERIES.

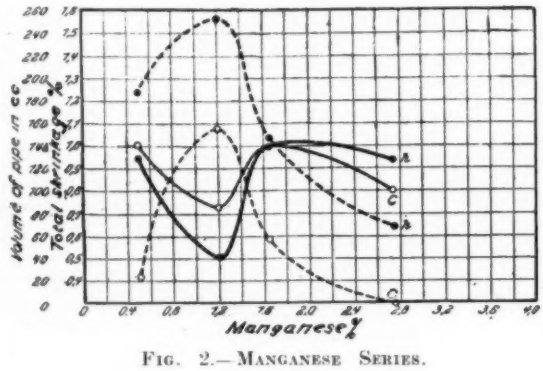


FIG. 2.—MANGANESE SERIES.

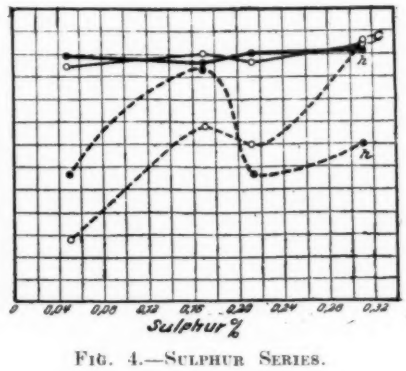


FIG. 4.—SULPHUR SERIES.

IN THESE GRAPHS ARE SHOWN THE TOTAL SHRINKAGE IN PERCENTAGES AND THE VOLUME OF PIPE IN C.C.S. PIPING IS SHOWN IN THE DOTTED LINE AND SHRINKAGE IN FULL LINE.

Transverse tests were carried out on the test-bars, and in connection therewith the writers sum up as follows:—

Silicon Series.—With increasing silicon content, the transverse strength decreases fairly regularly both with the "hot" and "cold" cast material. The transverse strength and deflection are slightly greater with the "hot" cast than with the "cold" cast bars.

Manganese Series.—With increased manganese, the transverse strength drops. There is little difference between the "hot" and the "cold" cast bars.

Phosphorus Series.—The transverse strength decreases with increase in the phosphorus content. As a general rule, the "cold" cast bars have a slightly higher transverse strength than the "hot" cast bars, whereas the deflection is slightly less.

Sulphur Series.—The transverse strength figures were not appreciably affected by increase in the

sulphur content. The deflection in the "hot" cast bars is greater than with the "cold" cast. The strength values are approximately the same as those for the silicon group of test melts. These results again confirm previous results, *viz.*, that a high sulphur content does not appreciably affect the strength properties of grey cast iron, although it is detrimental to the purely metallurgical properties (shrinkage, piping, generation of gas, etc.).

As regards the general conclusions to be drawn from the tests, the writers declare that all substances which facilitate the precipitation of graphite, silicon, and phosphorus must tend to effect a diminution in the total shrinkage, whereas all elements which retard graphite precipitation (manganese and sulphur) increase the total shrinkage. Concomitant with this factor is the rate of cooling during and after solidification of the metal. The hotter the iron is cast, the more slowly does the total mass cool, and the more extensive the graphite precipitation. This supports the test results that, as a general rule, the "hot" cast bars exhibited a smaller total shrinkage than the "cold" cast ones.

As regards the nature and extent of piping in cast iron, the casting temperature has a preponderating influence. As a rule, the "pipes" in "hot" cast iron are larger than in the "cold" cast iron, but, on the other hand, they are generally surface pipes in the "hot" cast material, whereas the "cold" cast bars in the tests generally revealed no trace of piping at all.

A proper charge incorporating a judicious selection of the elements, tending to facilitate the precipitation of the graphite and, consequently, decreased shrinkage, a medium casting temperature, and, finally, the correct design of the piece to be cast, are the means of preventing piping and producing sound castings. A high percentage of sulphur should be avoided, because it facilitates "piping," both in hot and cold iron.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Chemical Requirement of Cast Iron.

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—Under this caption, in your issue of August 2, great sympathy is extended to the foundryman in his predicament of having to meet chemical and physical specifications. To assist him, it is suggested one or other should be omitted, the onus of the item left out to fall on the purchaser.

In most cases the purchaser, even nowadays, does not understand the implication of a chemical analysis when submitted to him, and accepts what is tendered as correct, until such time that any castings fail and he has to face the problem of proving to the manufacturer that the blame lies in the quality of the metal used and not to faulty design.

During the war, when enemy submarines were captured, it is an open secret that wherever possible the Diesel oil engines were dismantled and cylinder liners and pistons closely investigated to try and obtain information which would enable manufacturers at home to produce similar metal, which would successfully machine, and yet withstand the high temperatures experienced over a portion of their surface and the explosive force of the four-stroke cycle engine.

The first thing submitted to the manufacturer was *chemical analysis* obtained from the investigation for information as a desired basis.

Some few years ago, the writer had experience in a dispute arising over tubbing plates for lining colliery shafts, and in this case the experts built up largely their deductions on the *chemical analysis* obtained from faulty castings submitted.

The B.C.I.R.A., in solving the difficulties of foundrymen, give explicit recommendations with regard to *chemical analysis*.

To quote an article from page 95 of the same issue of THE FOUNDRY TRADE JOURNAL:—"The fact that the mechanical properties of cast iron depend upon its chemical composition has already been demonstrated by the systematic work of Wüst and his scholars. This knowledge is supplemented by Kestner's work on the machining properties of metals in general and cast iron in particular."

Actually, so far as transverse test-bars are concerned in physical requirements, some very erratic information may be gathered, and where a test can be carried out on the actual casting concerned, it is much more satisfactory.

Laboratories are now installed in a large number of works, and enthusiasm regarding chemical analysis does not seem likely to diminish, and even though the purchaser does not stipulate a definite chemical analysis in his specifications, I do not suppose it will in any way reduce the foundryman's troubles. He will still require the chemical analysis as a guide, in which case he carries more responsibility owing to the purchaser not even offering analytical information.

Where a purchaser decides to obtain his castings of a similar type from another firm, perhaps owing to trade circumstances, he could no doubt place a valuable amount of information in their hands—*including chemical analysis*—but if it is considered by the authorities on the subject not advisable to mention such details, it is quite possible the new manufacturer will have to learn some costly things in the school of experience.

No amount of chemical or physical research will solve the difficulty alone. A remarkable number of items help to control, and differ in conditions in a jobbing foundry day by day, not the least of which is the human element.—Yours, etc.,

Kulti, India. H. LEWIN.

[Whilst our correspondent really leaves his letter unfinished, we gather that he means to plead for a better understanding of what chemical analysis implies by both the foundryman and the engineer. —ED.]

Contracts Open.

Annan, November 6.—1,230 tons of cast-iron pipes and special castings of 9-in., 7-in., and 6-in. diameter, for the Annan District Committee. Messrs. Warren & Stuart, 94, Hope Street, Glasgow. (Fee, £2 2s., returnable.)

Burnham-on-Sea, November 3.—1,000 yards of 6-in. cast-iron pipes, together with specials, for the Urban District Council. Mr. W. H. Chowins, engineer, Burnham-on-Sea. (Fee, £2, returnable.)

Hexham, November 3.—For the Holme Cultram Urban District Council:—(a) One 8-in. station governor (water loading), with by-pass valves and connections, and (b) 8-in. cast-iron spigot and socket pipes, branches, bends, collars, etc. Mr. H. Lees, engineer, Gas Office, Hexham.

Standard Tram Rails in Australia.—Following an inter-State conference of tramway engineers in Melbourne, a suitable design for a standard rail for the Commonwealth was agreed upon. The object of the conference was to arrange for a rail which could be rolled in Australia. At present such rails are imported from Great Britain and America. It is suggested that the different tramway authorities should pool their requirements, so that the rails could be rolled in paying quantities either at Newcastle or Lithgow.

Indian Stores Purchases.—In a letter addressed to the Government of India Department of Industries and Labour, the Bombay Merchants' Chamber has urged the Government to buy all stores in India that can be manufactured in the country. The Committee of the Chamber states that without an assurance of the very large custom which Government requirements represent, the Indian manufacturers cannot venture to produce a particular class of article on the large scale necessary to keep down the cost of production. The Committee is strongly of opinion that the only remedy is to call for tenders in all cases in rupees in India, and leave both the Indian and foreign manufacturers to tender on equal terms as to price, delivery and exchange. If the Government once make it clear that it is going to call for all tenders in India, and in rupees only, the foreign suppliers and manufacturers will see to it in their own interests that the Indian market is provided with a cheap and sufficient supply of what they have to sell and some of them may ultimately find it advantageous to carry on the entire manufacture of their particular article in India, to the great advantage of the country. In fact, some of these manufacturers have already volunteered to start new factories provided the Government adopted a policy not to pass any orders without inviting local tenders, no matter whether they are manufacturers or not.

XUM

An Apprenticeship Course in Foundry Practice.—LXIII.

By Ben Shaw and James Edgar.

CHECKING PATTERNS.

It might be contended by some that the checking of patterns is not work that is likely to be given to an apprentice, and that therefore the treatment of the subject is out of place in a series of articles which is intended primarily for apprentices. On the other hand, there is no work done inside a patternshop that is of greater importance than checking, and while the apprentice may not be given the opportunity to acquire proficiency in the examination of patterns made by others, yet he should endeavour to get an understanding of the best methods of doing so. It is part of his craft. By observing the procedure adopted by the foreman or chargeman he will learn much—if he practices the proper checking of his own work before passing it to the foreman as finished—he may in time become a silent critic of the practice in the shop. The correct attitude for the apprentice with regard to this work, as indeed to his trade generally, is to recognise that the foreman and journeymen around him are drawing on the accumulated experience of years, but it is just possible that their mentality may not have been sufficiently keen always to determine correctly between good and bad methods, and he can best profit by their experience by using it as a standard for comparison. The apprentice cannot be advised too strongly to construct his work as if there were no final tribunal to judge it before it is sent to the foundry. The mental attitude of many men, as well as apprentices, is that as in their opinion they take every precaution against making mistakes when constructing the work, it is simply a waste of time for them to make a final comparison with the drawing. There are reasons why the checking is not sufficient, but it is certainly advisable, and more than ever at the present time, when patternmakers are working on the "payments by results" system, with a consequent temptation to allow bad work to pass.

Why Patterns are Checked.

Patterns are checked after completion for three reasons. They are: (1) To make sure they are satisfactory from the moulder's point of view; (2) to ascertain that the machining and other allowances are satisfactory; (3) to guard against measurement mistakes, which would render the resultant casting useless. The third reason is perhaps the most important, because, with regard to the first, a clever moulder can usually make a casting from a very badly made pattern. The casting may not be quite satisfactory, however; it will almost certainly cost much more than it ought to do, besides which the pattern may be practically ruined by the moulder sawing parts off which ought to have been made as loose pieces. As for machining allowances, it is frequently necessary to make extra allowances, as on top faces, or, it may be advisable, because of difficulty in machining an almost inaccessible face, to make as small a machining allowance as possible. Further, it is not uncommon to arrange for tool clearances to facilitate boring or planing. It is too often assumed by engineers who have little or no experience that the checking of patterns and core-boxes simply demand accurate comparison with the blue print or tracing. On the contrary, when using rule and callipers, the checker has always in mind the moulder's difficulties. He made decide—and especially does this apply to pipes and valves made "to place"—that it is necessary to leave extra metal on the backs of flanges. With steel work it is very common practice to make flanges and bosses of extra diameter and very customary also to allow a 1-16-in. extra metal on all parts to make good the losses owing to annealing.

Draughtsman as Checker.

The efficiency of a patternshop depends to a large extent on the careful checking of work. In some shops it is the custom for the draughtsman who has been responsible for the drawing to examine the patternmaker's work, and it is nearly always necessary for him to be accompanied by the foreman or charge hand patternmaker. In nine cases out of ten a draughtsman checker is incompetent, and in the tenth case the competency is the result of experience gained in patternshop and foundry. We mention this because we want readers to realise fully the high skill necessary for satisfactory checking. In some large patternshops, where the men are divided into squads, the leading man, who is responsible for the work of the squad, also checks the work. In other shops all the work is checked by the foreman or underforeman. An alternative method is to have separate checkers, who pass all work through their hands before being sent to the foundries. This dual system of charge hands and checkers has many objectionable features. The checker is placed at a disadvantage, because, not having set down the work, he is probably at a loss to understand the various allowances that have been left, besides which it is not unusual for modifications from the original drawing to have been agreed upon between the chief draughtsman and the foremen of patternshop and foundry. While we are discussing methods of checking in different shops, mention may be made of the system whereby two men working together examine all patterns and core-boxes. These two men are usually foreman and assistant foreman, and while the one reads sizes from the blue print or tracing, the other measures with rule and callipers. This system involves a waste of time, and may mean that other work is being neglected. It also necessitates division of responsibility, and, unless there is a very thorough understanding between the checkers, mistakes are probable.

Checking During Construction.

There are certain differences in the checking of large and small work. When a large cylinder or bedplate is being made it is not unusual for the foreman to check part of the work during the time of construction. This may be more properly classed as supervision, but if important parts, what may almost be termed pivotal parts because on their accuracy may depend the accuracy of many other smaller parts, are measured up before they are built up on a main body, much labour may be saved subsequently. A large pattern is invariably divided up into a number of jobs, and on each of these two or more men might be employed. In the case of a large L.P. cylinder there are the feet on which the cylinder rests, there is also the steam chest and the cylindrical body. The crown of the cylinder or a portion of it may also be completed as a separate pattern. It is obvious that it is much better to measure these various parts before they are assembled together, and if alterations are necessary to have them made. The final checking is then to a great extent the measuring of faces from centre lines and the testing of small branches and bosses.

It is not a commendable shop practice for the man who has made the work to be responsible for the final examination, but if it is done, it is quite essential that some time should elapse between the completion of the patternmaking and the examination. There is always the temptation for the patternmaker to allow slight inaccuracies on his own work to pass. It is a curious fact also that when a size has been taken from a drawing board wrongly it is very rarely indeed that re-examination of the drawing makes the mistake clear. For example, a size such as 2 ft. 6¾ in. may be read as 2 ft. 6¼ in. when setting down the work on the drawing board, and on subsequent reference to the blue print the patternmaker will almost inevitably read the size wrong each time. Thus the value of a fresh mind on the work before it leaves for the foundry cannot be over-exaggerated.

Checking Before or After Painting.

There is considerable difference of opinion as to whether work should be checked before it has been painted or varnished or afterwards. If alterations have to be effected, it is not only much pleasanter but also much easier to plane or chisel white wood. On the other hand, if any time elapses before the checking is done the pattern may warp and shrink considerably. The real argument for painting before checking is that the loose pieces are clearly marked and that metal and cores are outlined. This not only simplifies the checker's work, but it makes quite certain that the patternshop is clear of the responsibility of mistakes in coring, which might be made if metal thicknesses are painted on joint faces just before the work goes to the foundry, without any proper comparison with the drawing. In some patternshops it is really left to the discretion of the individual workman as to whether the pattern shall be painted first or not, and when this is the practice the apprentice may be advised to cultivate the habit of completely finishing his jobs before giving them to the foreman or checker.

Checking a Large Job.

It will be profitable if we discuss a customary method of checking a very large pattern. In all probability the foreman will have measured the workshop drawing and tested the length rods carefully before the commencement of construction. If he has not done so he will begin his work of checking by making sure that length rods and drawing are accurate. He will note carefully the various allowances that have been drawn on the board, and where these, in his opinion, have not been sufficient, he will probably make a note, so that if he considers it advisable he may have the pattern altered. On the other hand, when checking the drawing, it is almost certain that he will find slight discrepancies which are really unimportant, and, if he is wise, he will not insist on such discrepancies being made, according to his idea, right. The usual course when checking a large pattern is to take a general view of the whole work, trying loose pieces, and examining screws, which will have to be withdrawn during moulding operations. At this stage his criticism is all with a view to simplifying the moulder's work. The next task is to check centre lines. Here it may be remarked that some men when they are actually measuring a pattern use the blue print and almost ignore the drawing board. On the other hand, others put the blue print on one side altogether. The better system, in our opinion, is when setting down work not to cover the drawing with a multitude of details, such as ribs and small bosses, unless it is necessary to obtain fitting shapes, but to confine the drawing board to the large parts and refer continually to the blue print for details. When this is done the checker goes over centre lines, and tests large diameters and faces by comparison with the drawing board and leaves all the details until the last, when he closely scrutinises the blue print to be quite sure that no small boss or rib has been forgotten.

It is advisable, as a general rule, to make the checking of patterns and core-boxes two distinct operations. Great care and keen observation are necessary, especially when intricate core-boxes are being measured. It is usual to measure the most important boxes first, and when several cores fit into each other by means of prints these prints should be carefully marked, and the checker cannot be too particular in ensuring that the cores are just the correct size or a shade smaller. It is not the invariable practice, but it is certainly advisable, when there are a number of core-boxes, not to rely on the moulder's good sense, but to number each core-box and place a corresponding number on the core outlined on the drawing board which is being sent to the foundry. In addition, the number of cores required for each casting should be marked on the outside of the core-box, thus "2-off, for job No. 504." The particulars of the alterations should also be given on the outside of the core-box, as "2-off thus, then 2-off altered." It may be mentioned also that it is quite a usual practice when there are alternative methods of moulding a pattern to print on one side "cast this side up." The reason for doing so is fairly obvious. The moulder who has not the blue print beside him does not know what faces are wanted of specially clean metal, and it may be more convenient for him to cast a side down in the mould which is less important than the side which he casts on a top face. The outsides of core-boxes are usually unpainted; it is therefore advisable to varnish over any particulars written on them to preserve the information for use in the foundry.

Checking Medium and Small-Sized Work.

It is in checking medium and small work that the apprentice will obtain his practical experience, because it is very unlikely that he will be placed in charge of a number of men constructing a large pattern before he has completed his apprenticeship. The surface table is a very great help when checking small work, although it is not found in all patternshops, because one large face may be set on the table and set squares and templates used for testing other faces. Just as in large work, there ought to be a preliminary examination to ascertain that the pattern can be moulded conveniently, that machining has been left where necessary, and that taper has not been overlooked. The actual amount of machining can be measured when testing. Some patternmakers adopt the method of checking pattern and core-boxes with each view in turn, but this inevitably leads to measuring the same parts several times. It is also a better way, in the first place, to check all the lengths, then all heights, then widths. There may be a final examination of details, such as ribs and bosses. The radii of fillets may be of great importance, and all templates that have been used to obtain irregular shapes should be very carefully checked. This is not always done, but it is not possible to make quite sure that metal thicknesses are correct if templates for pattern and core-boxes are not compared together. When checking core-boxes, it is often advisable to make them slightly smaller than the drawing sizes, but in no case should they be allowed to go to the foundry so that it will be necessary for the moulder when setting his cores to card them to obtain the required thicknesses. When patterns are jointed horizontally and moulded in two or three boxes it is impossible for the moulder to prevent the work from "growing." Thus a valve with top and bottom branches, with the faces of top and bottom branches at a distance of 18 in., will grow, probably as much as $\frac{1}{8}$ in. if there are several joints. It is very good practice when a few castings have to be made from a pattern for the patternmaker to go into the foundry after the first casting has been dressed and measure the main sizes to see how far he has erred in making allowance not only for the growth of the mould, but for contraction. The apprentice may not have the opportunity of doing this during working hours, but the lessons to be learnt are so valuable that he would be well advised to spend part of his meal hour each day in the foundry. It is the practice in some shops to allow for the growth of moulds by measuring distances from horizontal joints to top and bottom branch faces with the standard rule if the work is iron, and with the iron contraction rule if the work is of brass. This is a very satisfactory and simple method of making the necessary allowance for growth.

Other Considerations.

When it is possible it is an altogether good method of checking to place the pattern on top of the core-box. This can only be done, of course, when the joints of pattern and core-box are on the same plane, and not always then. If the pattern is set by means of prints and a scriber is used for drawing the outline on the face of the core-box, the thickness of the metal can subsequently be checked with a rule. When several castings have to be bolted together it is oftentimes possible to place the patterns in the same relative positions that the castings will occupy; thus, in the case of a set of reciprocating engines, the various cylinders may be placed in line, and in this way discrepancies in adjoining faces are at once apparent. This is also often a means of tracing mistakes, such as the omission of small branches or bosses which may form connections

between cylinders. When this is done, the arrangement drawing is used supplementary to the several detail drawings.

In the case of shell patterns which have been turned inside and outside, there is frequently scope for ingenuity in testing thicknesses where it is impossible to use the ordinary double-ended callipers or even thicknessing callipers that can be released for withdrawal. It is never advisable to leave anything to chance. Templates which have been used for turning can be placed together on a flat drawing board, or a sprig bit—used as a last resource—will show the metal thickness. When checking plate patterns it is advisable that if these be cored they be compared with the core-boxes before being screwed on the plate. With regard to checking them in position on the plates, there are several ways of doing this, but the subject has already been fairly fully dealt with in a previous article.

Casting Bronze Tablets.*

By JACOB G. KASJENS, Brass Foundry Company, Peoria, Ill.

The casting of a bronze tablet is a very high-grade piece of work, and it is essential that careful attention be given to the flask, sand and every detail of the operation.

Flask.

The cost of making a tablet is so great that one is justified in using a high-grade flask. For a tablet about 20 in. wide by 30 in. long in size, a flask 35 in. wide by 40 in. long, inside measurements, should be used, the depth of the drag being 6 in. and the depth of the cope 8 in. Three-inch timber should be used for such a flask, and the corners should be well braced with angle iron. There should be 3 tie rods in the cope and a similar number in the drag. Bars should be fitted in the cope only. The guide pin should be well fitted, and, if a crane is available, there should be a trunnion on each end of the flask.

Sand.

Any good sand that is suitable for other fine brass work can be used for making tablets. It should be prepared the day before it is used. First, put it through a No. 10 sieve, adding about one part of kordex core compound, or any other good core compound, to 40 parts of sand. Sieve again through the same mesh so as thoroughly to mix the compound with the sand, then damp to the required moisture and sieve through a No. 4 sieve. The sand and compound by this time should be well mixed, and the heap should be covered overnight by well-dampened gunny sacks. This will give a strong, mellow mixture, which will not require brads to hold the particles of sand between the letters.

Ramming.

When the match is prepared and the pattern in place, a very small amount of lycopodium should be shaken upon the pattern. Any excess lycopodium should be blown off the pattern, or it will cause trouble when spraying the mould, as lycopodium has no affinity for water. Now put the drag in place, and to avoid "ramming away" from the letters or edge of the tablet, ram the facing sand by gravity, as follows:—

If a crane and electric riddle are available, hoist the riddle 10 or 12 ft. high. If no crane is at hand, a step-ladder can be utilised. Sieve about an inch of facing sand upon the pattern, then use a coarser sieve, and finally fill the drag from the same height. Peen around the ends and sides of the flask. Step off the mould and butt ram it. Before putting on the bottom board, vent freely with a wire of medium size to within a half-inch of the pattern. In ramming the cope, set a small sprue at each end for pop gates and a large sprue on each side, in the centre for pouring. Use about ¾ in. of facing sand, then fill in with other sand and ram it in the ordinary way. It is not necessary to ram the cope by gravity, there being nothing to "ram away" on the back of the tablet. Vent the cope in a similar manner to the drag.

*A Paper presented to the Cleveland Conference of the American Foundrymen's Association.

Lifting the Pattern and Spraying the Mould.

Secure the pattern so as to lift it with the cope, raising it very slowly to allow for breaking the vacuum. The gates to the casting should be about ⅜ in. wide by ⅜ in. deep, and they should be about 1½ in. apart. It is not necessary to flour the mould. It should be sprayed, however, with molasses water, using one part of molasses to 15 parts of water and heating until thoroughly mixed. Use the ordinary foundry spray can with 60 to 80 lbs. of air pressure. The can should be far enough from the mould and held sufficiently high, so that the molasses water will reach the mould in the form of a mist. About two quarts of the spray mixture should be used on the drag of a mould for a 20-in. by 30-in. tablet, and about half this quantity for the cope.

Drying.

It will not be found necessary to dry the moulds in the oven, but this can be done by means of a gas torch. The drying process should not be allowed to proceed too rapidly, thus avoiding blistering the face of the mould and burning the pyramids of sand.

Clamping the Mould.

Before closing the mould, plenty of paste should be used on the joints of the flask to avoid run-outs. Clamp the flask carefully, and then place an iron rail or I-beam across it, fitting wooden wedges between it and the bars in the cope, so that the sand in the centre of the cope cannot rise during pouring.

Pouring.

On a tablet of the size mentioned above, two crucibles should be used for pouring. Where tablets of a greater area are made, additional crucibles should be used so as to cover the required area with safety. Unless this precaution is taken, strained or mis-run castings will result.

Alloys.

Any standard art bronze alloy will run well and make a good casting. In some cases it may be necessary to use a special mixture in order to match the colour of bronze work already in place.

Melting.

Whether the melting is done in crucibles or open flame furnaces, care should be exercised to avoid overheating the metal. It should at all times be covered with charcoal.

Cleaning Castings.

When a casting is taken from the mould, it should be examined by filing a number of letters several places on the face of the border in order to ascertain whether it is free from pinholes. If the casting is found to be sound, the gates can then be removed and the casting cleaned.

Finish.

In finishing the casting, the border surface is filed straight, the letters are faced and then draw-filed to take out the waves.

Colouring or Ageing.

In order thoroughly to clean the face of the tablet and give the acid dip an opportunity to act uniformly, the casting should be cleaned by the sand blast before starting the colouring process. It requires considerable skill and experience to bring out the beautiful colour desired.

Final Finish.

For the final finish, fine emery paper fitted to a block of wood is used, and all polished surface rubbed one way to eliminate waves. When a tablet has to be placed inside of a building, it is lacquered. Tablets that go outside age better and more quickly if not lacquered.

Conclusion.

The making of tablets in a jobbing foundry requires so much attention and care that it naturally influences the general character of the work done in such a foundry. For this reason it is desirable work, because it will raise the standard of the work done by the foundry along other lines.

XUM

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Nomenclature of Semi-Steel.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—As a foundry chemist I have noted with pleasure that certain consulting chemists are attempting to re-name "Semi-Steel" by substituting "Steel-Mix Iron." For a long time the term semi-steel has been applied to such a wide range of material that its usefulness has been destroyed by its vagueness. Whereas semi-steel is a practically meaningless expression, the suggested "x per cent. Steel-Mix Iron" (where x is the actual percentage of steel used) conveys an absolutely definite idea. It is to be hoped that the numerous technical societies will take up this matter and so help to popularise this new name.—Yours, etc.,

J. C. A. SMITH.

72, Harcourt Road, Sheffield.
October 23, 1923.

Neglected Foundry Educational Facilities.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—I should like to join with you in the remarks under Neglected Foundry Educational Facilities, and to explain briefly how the solution of the foundry apprentice problem has been attempted by my employers.

For several years the firm has had an excellent apprenticeship scheme operating, framed to apply to the engineering and foundry apprentice alike. The duration of apprenticeship period is 5 years, and the entrance age 16.

It is incumbent on the apprentice that he attend classes on two evenings in each week. He is expected to obtain a low minimum number of talent marks by the evening studies, attendance and shop practice. He is guaranteed a thorough practical training in their engineering works—an experience to be envied, as the firm produce very high quality engineering products. Other advantages are:—Membership of a splendidly organised social and athletic club; medical attendance and a substantial bonus on completion of the apprenticeship period.

The works facilities are well known to the local education authorities, who direct quite a number of good apprentices to all departments except the foundry. I know of no single case where a boy has requested foundry apprenticeship from this source.

Out of a large number of foundry apprentices, September, 1923, saw only one entrance, the son of a far-seeing draughtsman.

After many conversations with the boys, individually and collectively, we came to the conclusion that the evening classes were the chief obstacle. To meet this apathy it was decided to modify the scheme to favour and interest the foundry boys only. The attendance at evening classes was waived. Classes on foundry practice and kindred subjects were to be organised and held on the works at about 10.30 a.m. to 12 a.m. on two mornings in the week during the usual winter session period. It was soon evident that, at last, we had created interest in the boys, and we expected most of them to join the modified scheme. They were given ample time to digest the arrangement and consult their parents. Evidently they consulted moulders and coremakers too, for only three boys presented themselves for enrolling. Such a small number ruled out, for the time being, the utility of carrying on the works educational classes, but the boys decided to adopt the general works-apprenticeship scheme.

That the foundry does not secure the best class of apprentice is painfully true, but it would appear that with an attempt at united action on the part of the engineering employers a real solution might be found. I have yet to learn of any definite consultation between employers and the foundry trade unions about the education of the foundry apprentice. I believe that the journeyman moulder and coremaker could do as much as the employer to induce apprentices to avail and interest themselves in the very excellent educational facilities offered by educational authorities and several of the large engineering companies. The influence of the journeyman on the apprentice is very marked. He is intimately in touch with the boy, and can put on a bias the one way or the other until the boy has reached an age of better understanding.—Yours, etc.,

E. LONGDEN.

80, Regent Road,
Handsworth.

The British Cast Iron Research Association.

Monthly Circular No. 22.

Semi-Steel.

During the recent visit of Dr. Moldenke of America to this country he expressed some very interesting remarks as to the manufacture and nomenclature of semi-steel. There is no doubt that better methods of manufacture will have to be adopted if its production and use are to progress. The Association has carried out numerous investigations for its members, and has collected a large amount of data upon the methods adopted by various makers. Although the Association are not yet in a position to state that definite conclusions have been arrived at, they can offer considered advice to its members upon the best melting practice to adopt. This has been done in many cases, with the result that mixture and melting processes have been improved. When the Association has completed its investigations there is no doubt that it will be able to make such a report to its members as will enable them to produce a material that will be of widespread use.

Director of Research.

The Council regret very much to have to announce that Dr. P. Longmuir has had to resign the post of Director to the Association through breakdown in health. Although only appointed in October, 1922, Dr. Longmuir has for some time been very ill following a severe attack of influenza. The duties of Director to an Association like this are very arduous, and, acting upon medical advice, Dr. Longmuir has been compelled to relinquish the work, which will take effect at the end of October.

Supplying Pig-iron to Analysis.

A circular giving recommendations for supplying pig-iron to analysis has been circulated to the blast-furnace owners in this country by Dr. R. Moldenke and Mr. W. Wood on behalf of the American Society for Testing Materials. The recommendations will be carefully considered by this Association in due course.

Research Bulletin No. 3.

The members will find the new issue of very great interest. It contains reports upon investigations on malleable cast iron; annealing, hardening and ageing of grey cast iron; growth under repeated heatings; cylinder castings; reduction of total carbon; fatigue of cast iron; copper in cast iron; Diesel engine pistons and temperatures.

Bureau Bulletin No. 2.

The second Bulletin is now being issued to members and associates, and contains some very useful foundry technical information. The series of articles upon foundry sands are commenced, the first portion giving the properties and composition of moulding sands. Growth of cast iron is a matter that seriously affects all foundry work, and extensive résumé of the literature upon the subject is given in a manner enabling all the accessible data to be readily digested. An important research by Belden upon cupola gases and temperatures is reproduced which will be very useful in cupola working. Illustrations showing the region of combustion are given, which will remove any doubts in the minds of foundrymen as to the processes that take place in a cupola during a melt. Other articles are upon heat treatment of grey iron, and methods of making cupola mixtures. There are forty pages of abstracts of foundry literature, which, together with particulars of recent patents, foundry data and list of new publications, make up a bulletin of eighty-three pages, which should be of the utmost value to the industry.

XUM

Trade Talk.

UDDEHOLM GENERAL AGENCIES, LIMITED, have established offices at 111, New Street, Birmingham.

THE ANGLO-OVERSEAS ENGINEERS & MERCHANTS, LIMITED, have removed their offices to Oswaldestre House, Norfolk Street, Strand, W.C.2.

METALS (1923), LIMITED, Caledonian Works, Banbury Street, Birmingham, have been granted a licence under the Non-ferrous Metal Industry Act, 1918.

THE BUSINESS carried on under the style of the East Gloucestershire Engineering Company, Limited, at Queens Lane, Cirencester, has been discontinued.

MR. J. H. L. JONES has established himself in business as an engineers' agent at Prudential Chambers, 34, Commercial Street, Newport (Mon.).

YORKSHIRE ENGINE COMPANY, LIMITED, have removed their London offices from 15, Caxton House, to 83, Buckingham Palace Road, Westminster, S.W.1.

JOHANNING & COMPANY, of 18, Chapel Street, Liverpool, announce that owing to structural alterations of the building their address will be 12, Rumford Place, Liverpool.

A LECTURE was given at the Sheffield Metallurgical Chemists' Society's new premises, West Street, Sheffield, last week, by Mr. A. Allison, on "Pickling Steel."

JOSEPH KAYE & SONS, LIMITED, Lock Works, Leeds, have recently received a contract from the Admiralty for their improved force-feed type of serrated steel seamless oilcans.

WM. BOBY & SON have changed their name to William Boby & Company, Limited, and their address is now Brookfield House, 62 and 64, Brook Street, Hanover Square, W.1.

MR. SLATER WILLIS presided over the first meeting this session of the Rolling, Forging, and Tilting Trades Technical Society, held on October 19, at Sheffield, when an interesting lecture on "Modern Rolling Mills," by Mr. T. W. Hand, was heard.

RICHARDSONS, WESTGARTH & COMPANY, LIMITED, have made an offer to the debenture holders to purchase at par the whole £350,000 4½ per cent. debenture stock of the company. Interim dividends at the rate of 6 per cent. per annum have also been declared on the preference and the ordinary shares.

AT THE FIRST MEETING of the session of the Institution of Engineers and Shipbuilders in Scotland, held on October 16 in Glasgow, Mr. J. Howden Hume delivered his presidential address, taking for his subject the economical increase of steam production by mechanical draught and recovery of waste heat.

THE COUNCIL of the Institution of Civil Engineers have made the following awards in respect of selected engineering papers published without discussion during the session 1922-1923: A Watt Medal to Mr. T. E. Houghton (Liverpool), and Telford Premiums to Mr. J. W. Meares (Guildford), Mr. J. W. Spiller (Maidenhead), Mr. G. S. Coleman (Manchester), and Mr. Dempster Smith (Manchester). For papers read before meetings of students: Miller Prizes to Mr. E. L. Everatt (Newcastle), Mr. J. G. Kimber (London), Mr. A. H. Naylor (London), Mr. E. Sykes (Birmingham), and Mr. F. J. Symonds (London).

IT WAS ANNOUNCED at the annual meeting of the Northern Section of the Junior Institution of Engineers that the section silver medal awarded by the Institution for the best paper read at the local meetings was again awarded to Mr. J. Calderwood. The election of officers resulted as follows: Mr. H. I. Brackenbury, president; Mr. J. Calderwood, chairman; Mr. Lee, vice-chairman; Mr. G. S. Lisle, treasurer, and Mr. B. F. Tree, secretary. Committee: Messrs. D. H. Brock, M. N. Fletcher, J. W. Marshall, J. G. Proud, S. J. Dransfield, T. Grime, A. S. Hills, A. Howell, J. R. Lyall, F. N. Macfadyen, J. Murray and W. Taylor. The president gave an address entitled "Musings Without Method."

THE BIRMINGHAM CHAMBER OF COMMERCE, on Thursday, October 25, discussed with a number of representatives of the foundry industry at the Chamber the date and venue of an International Foundry Trades' Exhibition which they are proposing to hold next year. Mr. H. Lakin-Smith, chairman of the Exhibition Committee and Senior Vice-President of the Chamber, presided. He said they did not desire to do anything without the co-operation of the Institute of British Foundrymen, and the British Cast-iron Research Association, and they hoped also to have the assistance of the Non-Ferrous Research Association. He hoped the meeting would realise the great opportunity which must arise from the coincidence of the British Empire Exhibition. Mr. V. C. Faulkner, President of the London Branch of the I.B.F., said that the general view of the foundrymen was that such exhibitions should be triennial. This view was endorsed by Mr. J. Horton, on behalf of American exhibitors at Bingley Hall, who called attention to the fact that the consensus of opinion at the Paris Exhibition was that such international exhibitions should not be attempted more often than once in three years.

Company News.

Babcock & Wilcox, Limited.—Interim dividend, 5 per cent., tax free.

Anderston Foundry Company, Limited.—Interim dividend, 3s. per share, less tax.

W. Stuart Miller, Limited, 435-6, Royal Exchange, Manchester.—Capital £20,000 in £1 shares. Iron merchants.

Archd. Reid & Sons, Limited, Moorpark, French Street, Renfrew.—Capital £6,000 in £1 shares. Anchor and chain manufacturers.

Automotive Components Company, Limited, St. Bride's House, Salisbury Square, London, E.C.—Capital £2,000. Manufacturers of and dealers in machinery of all kinds, etc.

Henry Berry & Company, Limited.—Net profits, £9,632; brought forward, £24,898; final dividend, 10 per cent. on ordinary, making 20 per cent. for year; carried forward, £19,229.

Coltness Iron Company, Limited.—Trading profit, £213,038; appreciation of investments, £1,650; written off for redemption and depreciation, £44,313; total, £170,374; set aside for special repairs, etc., £5,000; brought forward, £21,738; ordinary dividend, 8 per cent.; ordinary reserve, £90,000; carried forward, £29,362.

Richard Klinger, Limited.—Capital £250 in 1s. shares, to acquire the business of H. L. Mason, 120, Southwark Street, S.E., trading as "Klinger Patents," and to act as agents for Richard Klinger, G.m.b.H., Vienna, Richard Klinger, Actiengesellschaft, Berlin, and N. V. Klingerit, of Rotterdam. H. L. Mason, first managing director.

Personal.

IN CONSEQUENCE of the death of Mr. C. F. Dixon, who was chairman and managing director of the Cleveland Bridge & Engineering Company, Limited, Mr. W. E. Pease, M.P., has been elected chairman, and Mr. J. R. Dixon managing director.

MR. S. KAY, recently associated with the sales department of the Unbreakable Pulley & Mill Gearing Company, Limited, and the Cooper Roller Bearings Company, has been appointed manager of the King's Lynn works of the Cooper Company.

LIEUT.-COL. W. THOMLINSON, for many years managing director of the Seaton Carew Iron Company, Limited, is retiring from active business. He was also a director of the Carlton Iron Company, Limited, now Dorman, Long & Company, Limited, and started the Norra Haksberg mines in Sweden.

Obituary.

MR. J. L. GUDGER, of John Gudger & Son, metal merchants, Knowl Street, Stalybridge, died on October 11.

MR. H. W. JOHNSON, who was for many years with D. F. Tayler & Company, Limited, metal rollers and wire drawers, of Newhall Works, George Street, Birmingham, died recently, aged 77.

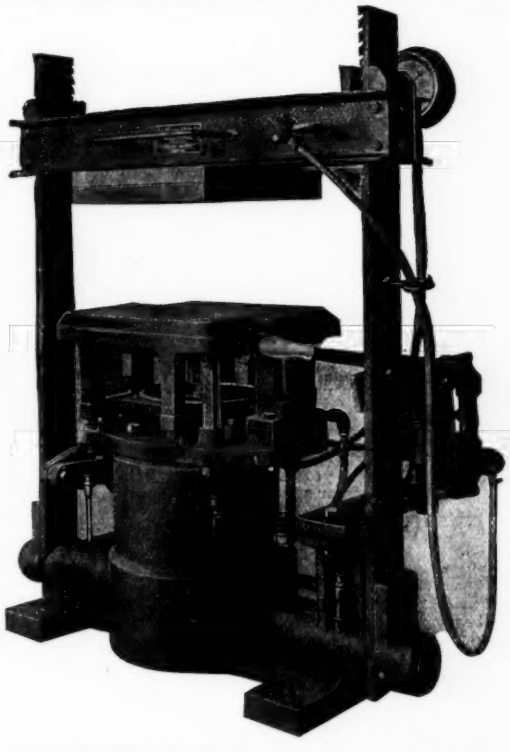
CAPT. WYNDHAM PARTRIDGE THOMAS, son of Mr. Richard Thomas, founder of Richard Thomas & Company, Limited, died last week. About 48 years of age, Capt. Wyndham Thomas had not enjoyed robust health for some time, but it was not until Friday last that his condition gave cause for anxiety. A well-known figure in the iron and steel industry, Capt. Wyndham Thomas had been a director of Richard Thomas & Company, Limited, since 1919, when the firm absorbed the Cwmfelin companies. As managing director of the Redbourn Hill Iron & Coal Company, Limited, a subsidiary company the shares of which are owned by Richard Thomas & Company, he devoted himself energetically to the development of that undertaking. He held the managing directorship during the critical years of the war, and was responsible at the time when important constructional work was undertaken, involving an outlay of between two and three million pounds. In his earlier days he had associations with the steel and tinplate trade of South Wales, and after his close association with the Redbourn Works ceased, owing to his disturbed health, he visited South Wales at intervals in connection with the business of Richard Thomas & Company.

MACNAB & Co.

TABOR MOULDING MACHINES (TABOR PATENTS)

For Every Class of Work.

Pit Type and Portable Combination Shockless Jar Ramming Power Roll-over and Pattern Drawing Machines; Power Squeezing and Jar Squeezing Machines; Shockless Jarring Machines, etc., etc.



SPECIAL FEATURES AND ADVANTAGES:

Accurate Definite Draw with Permanent Accurate Alignment.

All Operations Controlled by One Lever.

Uniformity in size of Castings produced.

All Moulds squeezed alike to whatever Pressure Required.

Minimum Percentage of Wasters.

The above illustrates the TABOR POWER SQUEEZING "SPLIT PATTERN" MOULDING MACHINE, specially suitable for all small patterns which can be split in halves or for flat back Work.

A customer writes—

"The Machines draw perfectly in producing deep castings with the minimum amount of taper, and we are fully satisfied with them, as they are most economical in use and give the maximum production."

Capacities and Dimensions furnished upon application:

56/8, Eagle Street, Southampton Row, London, W.C.1.

Works: TOTTENHAM, LONDON, N.17.

IRON AND STEEL MARKETS.

Pig-iron.

MIDDLESBROUGH.—The improvement recently noted in the pig-iron industry in the North-Eastern area has not only been fully maintained, but has developed with increasing strength, last week's Cleveland market experiencing a remarkable advance in values, raising the standard of No. 3 G.M.B. quality to 100s. per ton, or 4s. above the price quoted the previous week. This rapid advance is mainly attributable to heavy buying on Scottish account, due to bear operations by merchants, who now find themselves awkwardly situated when deliveries of iron are due. This led a fortnight ago to a sudden rush on the part of speculative buyers to cover in the Cleveland market, and with some of the Tees-side makers holding off temporarily quotations advanced, with adverse results to the bear operators. While in some respects the advance may be regarded to a certain extent as artificial, the fact remains that with No. 3 at about 96s. makers have been losing money, and that even now 100s. barely meets the cost of production. Moreover, fuel is firmer than ever, and the prospect of any relief over the winter months seems to be remote. The stocks of Cleveland foundry pig-iron in makers' hands, which were very heavy up till quite recently, have now been reduced to quite manageable proportions, and this is an important factor in the price advance recorded this week. Quotations now rule as follows:—No. 3 G.M.B., 100s.; No. 1, 107s. 6d.; No. 4 foundry, 99s.; and No. 4 forge, 97s. 6d. to 98s.

There has been no very marked change in the hematite position on Tees-side, though the indications of steady improvement, due to the increasing activity at the steelworks, continue. Once again foundry iron is on the same level as hematite, and this is an occurrence which is rarely more than temporary. Moreover, the outlook all round for hematite is distinctly more encouraging. Hence at last week's market there was but little iron to be bought at 99s. 6d., and most makers are now inclined to hold out for 100s. per ton for East Coast mixed numbers. In West Cumberland and North Lancashire prices are higher, with Bessemer mixed numbers quoted at 112s. per ton delivered at Glasgow and Sheffield, and 117s. per ton at Birmingham. As heretofore, the greater proportion of the make passing out of this district is going to the Midlands.

MANCHESTER.—Actual demand for foundry iron in this area is still inactive, but there seems more disposition to enlarge buying for forward delivery, though not in any substantial volume. Buyers in the local market maintain an attitude of reserve, but seem less confident that prices of foundry pig are likely to go any lower. Without cheaper coke it is, of course, a little unreasonable for the consumer to expect cheaper iron. This is not an impossibility, for pig-iron has often been sold below cost of making, but it seems more probable that if the Midland furnaces cannot get rid of their output at present prices they will damp down rather than sell below 90s. per ton. The delivered price in Manchester now is 100s. or more per ton for No. 3 Midland iron. Scotch No. 3 is rather firmer, and some sellers are quoting 118s. per ton for it, but at such a figure the ironfounders here can use very little.

THE MIDLANDS.—At Birmingham market last week a slight improvement in demand for pig-iron was noted, with quotations on a distinctly firmer basis. From the smelter's point of view there is also an improvement with regard to fuel. Coke supplies are not only cheaper but more ample. So far it is too early to say whether the market has started steadily on the upward grade which will lead to the relighting of some of the furnaces that have been idle for so long, but the position is being watched very carefully, and there will be an increase of production the moment conditions warrant it. So far, the expansion of demand has occurred more in foundry iron than in forge, though both grades show some improvement. Quotations:—Northamptonshire No. 3 foundry, 92s. 6d.; Derbyshire No. 3 foundry, 92s. 6d., all net f.o.t. furnaces.

SCOTLAND.—Corresponding with the increased activity in the Cleveland area the tone of the Scottish pig-iron market also denotes improvement, and a considerable volume of business has been closed during the past week. The price of No. 3 Scotch foundry has appreciated by about 3s. per ton to 101s. at the furnaces, but this figure is still below cost, and makers are accordingly trying to keep their commitments down, preferring to retain some iron in hand to enable them to take advantage of the better prices which they hope will materialise shortly. In any case, Scotch iron is exceedingly cheap, as compared with No. 3 Middlesbrough, for which the makers are quoting to-day 107s. at Grahamston (though merchants are prepared to accept less), as against No. 3 Scotch at about 5s. per ton less.

Finished Iron.

With a more hopeful prospect of a termination of the labour difficulties in the shipbuilding industry, the various branches of the finished-iron trade are sharing to a modified extent in the general improvement, though manufacturers of the commoner quality bars have still substantial cause for complaint of a lack of demand for their products. In this section, too, the foreign competitor still holds the market in check, though he may not obtain such a large share of the business as the disparity in quotations might suggest. Crown bars remain very irregular. Of course, the volume of demand is immensely below the productive capacity of the industry, and as long as this is so there must be competition and irregularity of prices. It is stated that in their eagerness to obtain orders some sellers of Crown bars have taken even less than £11 10s., but notwithstanding, there are others who continue to hold out for £12. It is a remarkable thing under the prevailing circumstances that they are able to carry on at all, but they seem able to get their share of business. There is still a very poor inquiry for gas strip, mainly because it is much too expensive in comparison with steel strip, which displaces it for all ordinary purposes.

Steel.

While market movements in the steel industry do not, so far, suggest much improvement in the general situation, so far as makers' order-books are concerned, expectations based on projected schemes for winter unemployment afford promise of more business offering in the near future. There is, however, still considerable doubt as to the destination of the alleged stocks of German steel seized by the French in the Ruhr, the liquidation of which at the present time would certainly have an adverse effect upon markets. In alloys, silico-manganese is quiet, most consumers having sufficient stocks for current needs, and prices show little or no variation at the moment. There is still a considerable diversity of opinion among steel makers as to the suitability of this alloy over separate additions of silicon and manganese, but a good deal depends upon the character of the steel required. Ferro-manganese has been further reduced to £17. At Sheffield there is a rather better demand for basic billets, but acid qualities continue a slow market. The general tone of the market continues good. A very fair all-round inquiry is still coming along, although the volume of business actually placed of late is not large, buyers evidently having covered their requirements for the time being, and hesitating to commit themselves ahead. Current quotations for the standard sizes are as follows:—Coke, IC. 14 by 20, 112 sheets, 108 lbs., 23s. 1½d. per box; IC. 28 by 20, 112 sheets, 216 lbs., 46s. 3d. per box; IC. 28 by 20, 56 sheets, 108 lbs., 23s. 7½d. per box, with lights at ¾d. per lb. less, net cash, f.o.b. Bristol Channel ports.

Scrap.

Business in this class of material during the past week has continued on an improving scale, and in some markets there has been a sharp advance in the price of certain qualities, notably in heavy steel, which is selling well both in Sheffield and South Wales. In the North-East Coast area the foundries are getting busier, and are buying more cast iron in anticipation of further orders. Heavy cast iron of machinery quality has advanced to 86s. per ton delivered, and ordinary qualities to 83s. There is no change as yet in other descriptions, which are quoted as follows, all delivered works:—Heavy wrought-iron piling scrap, 75s.; special heavy forge, 85s.; cast-iron borings and heavy steel turnings, each 62s. 6d. per ton. In the Scottish markets also the scarcity of cast-iron scrap is becoming more and more marked, and there are very few parcels being offered at present. As previously mentioned, however, it will be wrong to look for too big an increase in the values of this class of scrap. Heavy machinery cast-iron scrap and scrap railway chairs run about 97s. 6d. per ton, and ordinary heavy cast-iron scrap about 90s. Light cast iron and furnace firebars are at 70s. per ton.

Telephone: 21, Penistone. Telegrams: "Durranns, Penistone."

ESTABLISHED 1863.

JAS. DURRANS & SONS., LTD.

Phoenix Works, Penistone NEAR SHEFFIELD.

BLACKING
PLUMBAGO
CORE GUM
WHITE DUST
COAL DUST

Manufacturers of

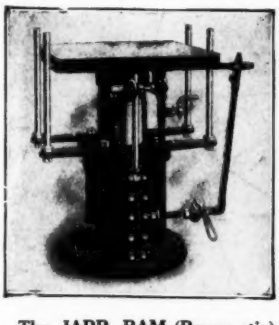
FOUNDRY EQUIPMENTS.

Ladles, Cupolas, Fire Bricks, Ganister, Stone Flux, Loam and Sand Mills, Casting Cleaners, Studs, Chaplets, Pipe Nails, Sprigs, Brushes, Wire Brushes, Core Ropes, Bellows, Buckets, Spades, Forks, Riddles, Sieves, Barrows, Etc.

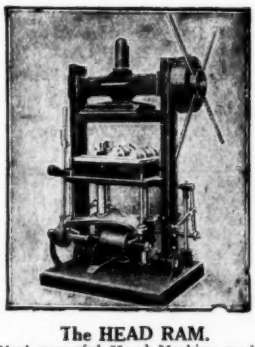
Write for illustrated catalogue on Blacking and Foundry Requisites, also for our latest Price List.

BRITISH MOULDING MACHINES

AND FOUNDRY EQUIPMENT.



The JARR RAM (Pneumatic).
The Machine with a Perfect Lift.



The HEAD RAM.
Most powerful Hand Machine made.

The HAND RAM.
Adjustable to any size box.

The most efficient machines, built to stand rough usage

WRITE FOR CATALOGUE TO—

Britannia Foundry Company, Ltd.

COVENTRY, ENGLAND.

METAL MARKETS—*continued.*

Metals.

Copper.—The standard market for this metal continues depressed, with values again substantially lower, having recently sunk below the £60 level for cash, while the turn over of actual business has been very moderate in volume. Occasionally speculative support, based on the intrinsic cheapness of the metal, has favoured sellers' views, but in the face of restricted European consumptive demand, and wild fluctuations in Continental exchanges, the relief has only been of a temporary character. Current quotations :—*Cash* : Thursday, £59 5s.; Friday, £59 15s.; Monday, £60 2s. 6d.; Tuesday, £59 17s. 6d.; Wednesday, £59 15s. *Three Months*: Thursday, £59 17s. 6d.; Friday, £60 7s. 6d.; Monday, £60 12s. 6d.; Tuesday, £60 7s. 6d.; Wednesday, £60 5s.

Tin.—The market for standard tin has of late developed exceptional strength, values at the close of last week's markets having appreciated to £208 cash, the highest quotation marked since May last, when £210 was reached. From that date it has fallen as low as £176 3s. 9d., but during the past two or three weeks it has remained fairly steady at just over £200. The general tone of the market is extremely cheerful, and it would seem that there is good cause for this feeling. The statistical position is good. A fairly steady demand is in evidence, and in addition, as has been previously stated, the tinplate industry in this country is flourishing. Production is not increasing to any large extent, and an additional steadying factor is that although the Federated Malay States are still sending 5 per cent. of their reserve stock to the market each month, it is being done in so judicious a manner that no violent price fluctuations are caused. Current quotations : — *Cash* : Thursday, £208; Friday, £207 12s. 6d.; Monday, £205 5s.; Tuesday, £206 5s.; Wednesday, £207 10s. *Three Months*: Thursday, £204 10s.; Friday, £204 5s.; Monday, £202 7s. 6d.; Tuesday, £203 7s. 6d.; Wednesday, £204 5s.

Spelter.—Although values in this metal have receded slightly, the tone of the market continues steady and firm throughout. Rudolf Wolff & Company state that the firmness is in a measure due to improved demand on the part of consumers, some fairly substantial orders having been placed for forward delivery. Producers and holders at the same time have shown a little more reserve, displaying rather less disposition to meet the demand. In America, moreover, the market has also been firmer following the advance on this side. Current quotations :—*Ordinary* : Thursday, £33 10s.; Friday, £33 12s. 6d.; Monday, £33 10s.; Tuesday, £33 10s.; Wednesday, £32 17s. 6d.

Lead.—The market for soft foreign pig continues the upward tendency previously reported, values having been inflated unduly by speculative manipulation. Arrivals have been heavy, but have made no impression on prices. Stocks meanwhile are reported to be of very small dimensions, and this impression has been given to consumers. The fact is, however, that on arrival the metal goes into private warehouses, while the consumer is forced to pay a premium for prompt delivery. The demand has improved somewhat, but with present prices consumers naturally buy only sufficient to satisfy immediate requirements. Current quotations :—*Soft foreign (prompt)* : Thursday, £29 10s.; Friday, £30 5s.; Monday, £30 10s.; Tuesday, £31 10s.; Wednesday, £31 10s.

S. PEARSON & SON (CONTRACTING DEPARTMENT), LIMITED, of Westminster, S.W.1, have obtained from the Chilian Government the contract for the extension of Valparaiso breakwater.

TO SECURE the necessary capital to carry through the recent purchase of the ordinary shares of the Grovesend Steel & Tinplate Company, Limited, the directors of Richard Thomas & Company, Limited, are making an issue to their own shareholders. This consists of 438,666 6½ per cent. cumulative preference shares of £1, and 219,333 ordinary shares of £1. Both classes of shares will be offered at par to the ordinary shareholders in the proportion of two preference shares and one ordinary share for every ten ordinary shares of their present holding.

IN THE COURSE of their report for 1922-1923, submitted to the annual general meeting of the North-East Coast Institute of Engineers, held on October 19, 1923, at Newcastle-upon-Tyne, the Council remark that the number of members on the register at July 31, 1923, after deducting the number of those who had died or resigned during the session and those whose names had been removed from the register for non-payment of their subscriptions, was 1,502. A Paper was read on "The Causes of Rapid Corrosion of Condenser Tubes," by Messrs. GUY D. BENGOUGH, R. MAY and MISS RUTH PIRRET, B.Sc.

Book Reviews.

Fundamentals of Welding. By James W. Owens. Published by the Penton Publishing Company, of 2-3, Caxton House, London, S.W.1. Price 50s.

This book is probably the most comprehensive treatise ever published on fusion welding, the only section not dealt with being the foundry process of "burning-on."

The author has been in the American Naval Dockyards, and though the subject is mainly dealt with from this point of view, it scarcely detracts from its value as a standard foundry text-book.

Foundrymen will appreciate Chapter 3, which gives very detailed instructions as to the procedure to be taken when gas welding.

Electric welding, dealt with in Chapter 4, contains a quantity of useful information for the man in charge of a steel castings dressing shop, where this process finds most favour under British conditions. Thermit welding, being so allied to "burning-on," is one of the foundryman's favourite methods of dealing with broken parts. The author's treatment of the subject, covering over fifty pages, is just what the foundryman requires. Perhaps the instructions are a little too detailed for an experienced man, but it is erring on the proper side, for, after all, text-books on welding are not too common. The repairing of a roll-neck, outlined on page 158 *et seq.*, is of especial interest to our readers.

When the author deals with the metallography of welding, he introduces such micro-constituents as sorbite and troostite. A large school of thought regards these as merely transition products, and as the book is meant for students, we suggest that this section should be made more simple or even eliminated in future editions. A well-considered chapter on the metallurgy of welding, introducing perhaps a little metallography, would probably meet the requirements of the average person studying the book.

The book is well printed and illustrated, and its general appearance is uniform with the majority of the Penton Library books. The book should be well received by British foundrymen, as it is a thoroughly comprehensive treatise on the subject of fusion welding.

Gazette.

MR. F. L. SHAW, carrying on business as F. L. Shaw & Company, 14, Boad Street, Store Street, Manchester, metal merchant, has been adjudicated bankrupt.

THE PARTNERSHIP heretofore subsisting between Messrs. J. Thompson and J. Walton, engineers, Atlas Works, Brighouse, under the style of Thompson & Walton, has been dissolved.

MESSRS. H. W. WELSH AND D. C. WELSH, engineers, 141, Hertford Road, Edmonton, trading under the style of the Edmonton Tool and Engineering Company, have dissolved partnership. Mr. D. C. Welsh continues.

A MEETING OF CREDITORS of A. T. Pryce, lately carrying on business as a brassfounder at Empire Works, Holliday Street, Birmingham, under the style of A. T. Pryce & Company, was held on Friday last. The debtor's statement of affairs disclosed a deficiency of £134. According to the observations of the Official Receiver, the debtor stated he had been out of business since January 28, 1922, when a deed of assignment for the benefit of creditors generally was executed. The liabilities then returned amounted to £3,072, the assets realised £642, and a dividend of 2s. in the £ was paid.

THE SHAREHOLDERS OF THE British Hydraulic Foundry Company, Limited, met on Friday of last week to consider a resolution that the company be wound up voluntarily, and that Mr. A. Whitson, iron and steel merchant, be appointed liquidator. In an explanatory circular the secretary states that the directors recommend the voluntary winding up of the company in order to conserve its interests. The results of the last three trying years, it is further stated, have convinced the board that it would not be wise to continue operations with the changed outlook before them. It is added that the present financial position shows that the capital is intact and largely liquid.